S. HRG. 101-835

# ASBESTOS ISSUES

## HEARING

BEFORE THE

SUBCOMMITTEE ON
TOXIC SUBSTANCES, ENVIRONMENTAL
OVERSIGHT, RESEARCH AND DEVELOPMENT

OF THE

COMMITTEE ON
ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE

ONE HUNDRED FIRST CONGRESS

SECOND SESSION

TO CONSIDER THE HEALTH RISKS OF ASBESTOS; IMPLEMENTATION OF THE ASBESTOS HAZARD EMERGENCY RESPONSE ACT; AND

## S. 1893

A BILL TO REAUTHORIZE THE ASBESTOS SCHOOL HAZARD ABATEMENT ACT OF 1984

APRIL 26, 1990

Printed for the use of the
Committee on Environment and Public Works

U.S. GOVERNMENT PRINTING OFFICE
33-509 WASHINGTON : 1990

For sale by the Superintendent of Documents, Congressional Sales Office
U.S. Government Printing Office, Washington, DC 20402

S321-44

## COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS

QUENTIN N. BURDICK, North Dakota, *Chairman*

| | |
|---|---|
| DANIEL PATRICK MOYNIHAN, New York | JOHN H. CHAFEE, Rhode Island |
| GEORGE J. MITCHELL, Maine | ALAN K. SIMPSON, Wyoming |
| MAX BAUCUS, Montana | STEVE SYMMS, Idaho |
| FRANK R. LAUTENBERG, New Jersey | DAVE DURENBERGER, Minnesota |
| JOHN B. BREAUX, Louisiana | JOHN W. WARNER, Virginia |
| HARRY REID, Nevada | JAMES M. JEFFORDS, Vermont |
| BOB GRAHAM, Florida | GORDON J. HUMPHREY, New Hampshire |
| JOSEPH I. LIEBERMAN, Connecticut | |

DAVID M. STRAUSS, *Staff Director*
ROBERT F. HURLEY, *Minority Staff Director*

---

## SUBCOMMITTEE ON TOXIC SUBSTANCES, ENVIRONMENTAL OVERSIGHT, RESEARCH AND DEVELOPMENT

HARRY REID, Nevada, *Chairman*

| | |
|---|---|
| MAX BAUCUS, Montana | JOHN W. WARNER, Virginia |
| JOSEPH I. LIEBERMAN, Connecticut | JAMES M. JEFFORDS, Vermont |

# CONTENTS

## OPENING STATEMENTS

Page
Lautenberg, Hon. Frank R., U.S. Senator from the State of New Jersey ............ 3
Lieberman, Hon. Joseph I., U.S. Senator from the State of Connecticut ............ 4
Reid, Hon. Harry, U.S. Senator from the State of Nevada ............ 1
Warner, Hon. John W., U.S. Senator from the Commonwealth of Virginia ........ 5

## WITNESSES

Delaney, Delores, member, board of directors, National Parent Teachers Association ............ 61
  Prepared statement ............ 222
Fisher, Linda, Assistant Administrator for Pesticides and Toxic Substances, Environmental Protection Agency ............ 18
  Prepared statement ............ 67
  Responses to additional questions ............ 83
Gee, Dr. J. Bernard, Professor of Medicine, Yale School of Medicine ............ 29
  Prepared statement ............ 141
  Letters:
    To the Members of the Subcommittee ............ 155
    To Senator Reid ............ 162
Landrigan, Dr. Philip, chairman, Department of Community Medicine, Mount Sinai School of Medicine ............ 31
  Prepared statement ............ 164
Lee, Henry, executive director, Energy and Environmental Policy Center, Kennedy School of Government, Harvard University ............ 26
  Letter to Senator Reid ............ 35
  Prepared statement ............ 104
Lemen, Richard, Assistant Director, National Institute for Occupational Safety and Health, Centers for Disease Control ............ 27
  Prepared statement ............ 114
Packer, Joel, legislative specialist, National Education Association ............ 49
  Prepared statement ............ 195
Shays, Hon. Christopher, a Representative in Congress from the State of Connecticut ............ 15
Siskin, Toni, chair, Federal Relations Network, National School Boards Association ............ 45
  Prepared statement ............ 175
  Report of EPA Audit on the Asbestos School Hazard Abatement Act ............ 184
Veith, Gregory, Council for American Private Education ............ 60
  Prepared statement ............ 211
Wallop, Hon. Malcolm, U.S. Senator from the State of Wyoming ............ 6

## ADDITIONAL MATERIAL

Mossman, Brooke T., associate professor, University of Vermont, letter with attachment ............ 284
S. 1893 ............ 295
Science Magazine:
  January 19, 1990, article entitled "Asbestos: Scientific Developments and Implications for Public Policy" ............ 264
  March 2, 1990, editorial ............ 273
  May 18, 1990, letters ............ 275
  June 1, 1990, letter from EPA ............ 282

Page

Statements:
  Simon, Hon. Paul, U.S. Senator from the State of Illinois .......... 51
  American Federation of State, County, and Municipal Employees .......... 237
  Batties, Sylvia .......... 259
  Building Owners and Managers Association .......... 261

# ASBESTOS ISSUES

---

THURSDAY, APRIL 26, 1990

U.S. Senate,
Committee on Environment and Public Works,
Subcommittee on Toxic Substances,
Environmental Oversight, Research and Development,
*Washington, DC.*

The subcommittee met, pursuant to notice, at 2:13 p.m. in room 406, Dirksen Senate Office Building, Hon. Harry Reid (chairman of the subcommittee) presiding.

Present: Senators Reid, Warner, Lautenberg, and Lieberman.

## OPENING STATEMENT OF HON. HARRY REID, U.S. SENATOR FROM THE STATE OF NEVADA

Senator Reid. The subcommittee today will hear testimony on the debate in the scientific community about the health risks associated with exposure to low concentrations of asbestos; on the implementation of the Asbestos Hazard Emergency Response Act of 1986, AHERA; and on the need to reauthorize the Asbestos School Hazard Abatement Act of 1984.

Debate in the scientific community about the dangers resulting from exposure to low concentrations of asbestos has been rekindled in recent months with the publication of two articles.

On June 29th, 1989, an article entitled Asbestos-Related Diseases, by Brook Mossman, an Associate Professor of Pathology at the University of Vermont, and Bernard Gee, Professor of Internal Medicine at Yale University School of Medicine, was published in the New England Journal of Medicine.

On January 19th, 1990, an article entitled Asbestos: Scientific Developments and Implications for Public Policy, by Mossman, Gee, and Jean Bignon, Director of INSERM, which is a research institute in France; Martin Carne, Director of the Division of Environmental Health Engineering at Johns Hopkins University; and Anthony Seaton, Director of the Institute of Occupational Medicine in Edinburgh, Scotland, was published in Science. Science is the journal of the American Association for the Advancement of Science.

Both articles suggested that the health risks associated with asbestos in buildings had been exaggerated. Both articles also suggested the removal of asbestos could often do more harm than good.

Few people disagree with the suggestion that the removal of asbestos, if done badly, may increase the exposure of building occupants to asbestos. Many within the scientific community, however, disagree with the suggestion that asbestos in buildings poses a minimal health risk to building occupants.

Such disagreement within the scientific community has led to public confusion about the dangers of asbestos. First, the public was told that a single fiber of asbestos might cause cancer. Now, they are being told that the risks of death from exposure to asbestos are less than those of being struck by lightning.

One of the purposes of this hearing, if not the most important purpose, is to clarify the dangers from asbestos in buildings. I hope that the scientists who are giving testimony today will use this opportunity to state clearly when asbestos is dangerous. Public education about asbestos has been particularly poor.

Clarifying the scientific evidence about the health risks of asbestos in buildings is also important to policymakers. It is vital that our policy toward asbestos be consistent with the facts. If not, our policy may well be counterproductive.

As well as testimony about the health risks of asbestos in buildings, this subcommittee will also hear testimony today about the implementation of the Asbestos Hazard Emergency Response Act. This act is the centerpiece of our efforts to deal with the problem of asbestos in schools. It requires schools to develop asbestos management plans and to abate asbestos in certain circumstances. What it does not require, and it is important to stress this point, is the removal of all the asbestos that is found in schools.

I think it is worth repeating this point. AHERA does not require the removal of all the asbestos that is found in schools. Many school districts have found the costs of meeting the requirements of this act to be prohibitive.

There is concern that asbestos abatement projects are consuming funds that could be used to hire more teachers, buy more computers, enhance sports facilities, and fund future capital development. School districts that face large bills because of the need to abate asbestos may be eligible for Federal funds under this act.

There has been some concern expressed about the formula by which these funds are distributed. Whether such concerns are justified will be examined at this hearing.

Also examined will be the question of whether this act needs to be reauthorized. Testimony will be given by a number of individuals today. Senator Wallop and Representative Shays will talk about the problems facing school districts of their constituencies. I would like to welcome both Senator Wallop and Representative Shays here today.

The EPA will present its views on the scientific debate, on the implementation of this law, and on the need to reauthorize this law.

A panel of scentists will present both sides of the current debate about the dangers of asbetos.

Groups representing public and private schools will give evidence about the reauthorization of this act and the problems their schools have experienced.

I would like to thank everyone who has agreed to give testimony today. As always, your testimony is important and the evidence given to us is important. I hope that everyone will be able to listen to all the testimony today. We are dealing with a very important subject, and all the facts need to be known.

I would like to welcome Senator Lieberman, who has been a stalwart member of this subcommittee and who has been present at all of the hearings we have held.

I would also like to welcome Senator Lautenberg to the meeting of this subcommittee. He has been a leader for not only his State but the Nation in developing legislation to address asbestos in schools. He is the sponsor of S. 1893, the Asbestos School Hazard Abatement Act, which I have also cosponsored.

I am pleased that you can join us today, Senator Lautenberg and Senator Lieberman.

## OPENING STATEMENT OF HON. FRANK R. LAUTENBERG, U.S. SENATOR FROM THE STATE OF NEW JERSEY

Senator LAUTENBERG. Thank you very much, Mr. Chairman. I want to thank you for calling today's hearing on asbestos and for joining with me as you have in introducing legislation to reauthorize the Asbestos School Hazard Abatement Act, ASHAA, which was signed into law by President Reagan in 1984. It was a bipartisan initiative. It and AHERA, the Asbestos Hazard Emergency Response Act, which followed in 1986, were based on extensive testimony presented before this committee that asbestos posed unacceptable risks to the health of school children and employees.

It is important to focus on what we did in those bills. We required that asbestos be monitored and managed, and we provided Federal assistance to help with that. We didn't require that all asbestos be removed. In many cases, as you said, Mr. Chairman, removal may not be the best course of action to reduce asbestos exposure and to protect the public health.

I applaud the efforts of EPA and others to inform schools of the most appropriate management options.

Mr. Chairman, I know that some of our witnesses will say that asbestos does not pose a significant health threat. I come from New Jersey, born in Paterson, New Jersey, where an eminent scientist who is represented by colleagues here today, Dr. Irving Selikoff, made the discovery of the dangers of asbestos. Perhaps he wasn't the first to recognize the hazard, but he was one of the most important. As a result of his research and the presence of a company in our State that manufactures asbestos material, we found out that the risk is substantial and ever present. It changed the course of manufacture in this country. We have seen brake linings made of different material because we had asbestos flowing through our air. We've seen evidence where a person who worked in a factory with asbestos materials brought home enough of that material to cause not only his own death by cancer, but that of his wife and his child as a result of exposure to the clothing that he wore on the job which had to be laundered at home.

So I think it's a little bit late to be saying that it doesn't present a significant health threat. Perhaps the structure or the character of the presence may be treated one way or the other, but these arguments about how dangerous it is or whether it is dangerous at all are arguments that we heard when we passed ASHAA initially, and AHERA. I am unwilling to say that we shouldn't worry about it.

The penalty of a miscue here is a pretty high risk. It's the lives of our kids, school employees. They are at stake.

Witnesses from EPA and CDC, as well as the Mount Sinai Medical Center, which has been a leader in studying the threats posed by asbestos, will testify that asbestos poses a health threat which must be addressed. While we must continue to study the threat, we also have to be vigilant in properly responding to it. Heaven forbid that any of us make an error in underestimating the danger of this material, thereby exposing children in the schoolrooms to something that can either end their lives prematurely or damage their health.

Mr. Chairman, I look forward to hearing from our witnesses and working with you to pass S. 1893 this year.

Senator **Reid**. Senator Lieberman.

## OPENING STATEMENT OF HON. JOSEPH I. LIEBERMAN, U.S. SENATOR FROM THE STATE OF CONNECTICUT

Senator **Lieberman**. Thank you, Mr. Chairman.

I essentially agree with all that you and Senator Lautenberg have said, so I would ask that the opening statement that I have prepared be entered into the record, and I would like to just say a couple of things.

It seems to me that while the current debate on the health impact of asbestos is of interest and should probably cause us to go back and take a second look, nonetheless, I for one remain convinced that asbestos is a toxic substance, and there are certainly circumstances under which it can cause very serious harm.

The second question, clearly, is the enormous cost that public institutions have had to face in dealing with the problem, and the concern that there is a misunderstanding out there that both Senator Lautenberg and you have referred to, about whether the law requires absolute removal or containment. I think we all agree that the law does not require removal of all asbestos in those buildings, that containment—in-place management—is just as appropriate.

I wonder, as we consider some of the testimony that we will hear today, whether part of the problem is not the activity of some of those who are independent contractors in this field who are responsible for the removal of asbestos from schools, who are in that business and may be misleading school authorities as to what their responsibilities are.

Mr. Chairman, you and I have spent some time recently dealing with another toxic substance, lead. It does seem to me that there are some parallels here. It is clear that while we have been focused on developing a technology to remove asbestos from buildings, we have probably not focused sufficiently on ways to contain it within buildings. That's the same as with lead. Similarly, as with lead removal, the removal of asbestos clearly can sometimes create more hazardous conditions than existed prior to removal. I think therefore we now have to focus some attention on research and development of containment techniques that are less costly than removal and safer for our children and others who work and exist in public buildings.

May I say that I personally welcome Congressman Shays, though I don't do it in person. I think he had to go out for a vote. I am sure that he will return as soon as he can, and I look forward to welcoming him then more directly.

[The prepared statement of Senator Lieberman follows:]

### Opening Statement of Hon. Joseph I. Lieberman, U.S. Senator From the State of Connecticut

Mr. Chairman, today we are discussing the risks of asbestos and reviewing what our national policy should be on protecting citizens from exposure to this substance. Recent articles have stimulated a new debate on the extent of the risk to building occupants form asbestos. Given the high cost of removing asbestos, questions have been raised about whether we have placed too much emphasis on removal of asbestos from buildings and insufficient emphasis on containment.

The recent scientific debate is not a reason to cease federal efforts to protect people from asbestos. More detailed, unbiased research may be necessary to determine when harm can occur and what the most appropriate protective measures are, although it is critical to remember that everyone agrees that asbestos is a toxic substance and can cause serious harm.

We must detemine where asbestos is located in schools and other public buildings. In conjunction with trained experts, decisions must then be made about whether removal is appropriate or whether risks can be controlled by in-place management. Nothing in existing legislation tells schools they *must* remove all asbestos found in their buildings. According to EPA, its schools program is based on in-place management, not on removal.

Perhaps, as Senator Wallop's amendment to the Clean Air Act suggests, EPA has not done an adequate job of communicating its support for in-place management and its desire to help schools determine when removal is appropriate. The remedy then, is to ensure that schools receive complete information on in-place management and effective guidance on when it is necessary to conduct a removal. We must not abandon our efforts to ensure that both our children and those who work in schools are protected. When a school is assessed pursuant to the Asbestos School Hazard Abatement Act, we must be concerned not only with the risks to the building occupants under normal conditions, but also the risks to those who service the building and the risks associated with working in an area where asbestos could be disturbed and released into the air.

As is true of another toxic substance that the Chairman and I have been working on, lead, it is clear that while we have been focused on developing the technology to remove asbestos from buildings, we have not focused sufficiently on developing ways to contain it within buildings. As with lead, removal of asbestos can sometimes create more hazardous conditions than existed prior to removal. We must now focus our attention on research and development of containment techniques that are less costly than removal and safer for our children.

It is important that we reauthorize the Asbestos School Hazard Abatement Act we ensure that EPA can provide schools and localities with the sound financial and technical assistance they need to identify and abate asbestos in schools. And we need a serious review of containment techniques which are as safe, if not safer, and less costly than removal.

I am pleased to welcome my colleague from Connecticut, Congressman Chris Shays who is understandably concerned about this problem. I look forward to hearing from him on this issue as I am sure will other members of this Committee.

## OPENING STATEMENT OF HON. JOHN W. WARNER, U.S. SENATOR FROM THE COMMONWEALTH OF VIRGINIA

Senator **Warner**. Mr. Chairman, I will forego and put my statement in the record as an accommodation to my colleagues.

[The prepared statement of Senator Warner follows:]

## OPENING STATEMENT OF HON. JOHN W. WARNER, U.S. SENATOR FROM THE COMMONWEALTH OF VIRGINIA

Mr. Chairman, I want to thank you for convening this hearing on the very important issue of the health effects of asbestos. As we all know, asbestos was in the news again recently with the publication of an article in *Science* Magazine suggesting that exposure to the most prevalent form of asbestos is of minimal health risk to building occupants.

The *Science* Magazine article has caused some to suggest that we should reverse the efforts already made for asbestos removal across the country. Others suggest that or national policy should require more aggressive removal action than already mandated by Congress. I look forward to hearing both of these point of view today.

The *Science* Magazine article points up the dilemma that we as policymakers face on so many environmental issues today. The article and the discussions it has inspired show that there is a true difference of opinion between highly qualified individuals as to what the health risks of asbestos are. In my view, in the face of this conflicting information, we in Congress ought to move carefully and deliberately, with a view towards protecting the public health to the maximum extent possible, without imposing unnecessary statutory requirements.

Today, we will also hear testimony on S. 1893, a bill to reauthorize the Asbestos School Hazard Abatement Act of 1984. I think that we can all agree that funding for this act needs to be reauthorized. I look forward to hearing from the views of those on the front lines concerning what they think the funding levels should be.

Thank you, Mr. Chairman.

Senator **REID**. Senator Wallop.

## STATEMENT OF HON. MALCOLM WALLOP, U.S. SENATOR FROM THE STATE OF WYOMING

Senator **WALLOP**. Thank you, Mr. Chairman. I would just say that Congressman Shays did have a vote and rather counted on your making a slightly more lengthy statements, that he might be back.

Senator **LIEBERMAN**. I'm going to save the warmth of my welcome for his presence.

Senator **WALLOP**. Mr. Chairman, by way of opening, let me just say that whatever the committee and the Congress intended to do in the schools thing and the American Trial Lawyers thing, that it does result in removal——

Senator **REID**. Say that again?

Senator **WALLOP**. I'm sorry. The school thing, and the American Trial Lawyers thing, it does require removal. They are unwilling to take the risk of liability and litigation over——

Senator **REID**. Tell us why you say that.

Senator **WALLOP**. Because I have talked to school superintendents who feel that they have no choice, that if they are to allow it there, they will soon be on trial for irresponsibility and liability for not having removed it, regardless of what the law says.

Senator **REID**. Have there been any lawsuits that have been directed toward the schools in that regard that you are aware of?

Senator **WALLOP**. I don't think, Mr. Chairman, that in this country you have to worry about whether there have been any. You have to worry about the general performance and the general tendency of this country to go to court. Public officials are now liable, as courts have ruled. That drives behavior, whether or not one likes to think so.

Mr. Chairman, the Congress is driven by the impulse to find problems and to respond with legislation. We may not correctly diagnose the problem nor develop sensible legislation, but we will act. Unfortunately, we also have to exercise oversight responsibilities to review the results of our actions.

Today your subcommittee is scrutinizing the impact of the Asbestos Hazard Emergency Response Act of 1986. As you know, the statute has generated a fair amount of controversy in recent years. In fact, the most recent scientific evidence calls into question the 1986 legislation.

Five years ago the Congress reacted to the growing national phobia about asbestos by enacting AHERA, conveying all the proper terminology, to alarm the public about the latest threat to their health, while reassuring them that Congress would take care of the problem. The bill passed the Senate with little debate and no dissent. We were all anxious to ensure that our schools posed no threat to the health of our children, and we were seeking the comfort of a zero risk world.

Communities around the Nation have since discovered that eliminating risk is a costly and often impossible task. I previously discussed the asbestos cleanup fiasco at Kelly-Walsh High School in Casper, Wyoming. This year-long school closure will cost the school district only $4 million. That is money we should be using to achieve the educational goals we have set for the year 2000. Congressman Shays will describe a more costly cleanup in his State. I understand that a $10 million removal project is underway in a California school, and yet today we are preparing to expand the school-based program to cover all public and commercial buildings. The cost will be as much as $150 billion.

But the genuine question is, will public health be improved? And will we eliminate risk by these expenditures?

Today's hearing is also an occasion to review the Asbestos School Hazard Abatement Act of 1984. The law provides Federal loans and grants to schools to assist with the cost of school asbestos response action.

The 1986 statute has created one more costly burden for local government. I was made well aware of that problem on the visit to Kelly-Walsh High School. As it is, the school district cannot receive any Federal financial assistance for their costs. It is not that they should not receive the grants, but are penalized by Federal regulation. I have discussed this problem with EPA and the agency is currently reviewing improvements in the program, which may be outlined today by EPA's witness.

Two years ago EPA reported to the Congress on asbestos exposure problems and solutions for buildings containing asbestos materials. The report contained several interesting comments and conclusions which go to the heart of the current debate.

EPA states that occupational levels of exposure to all forms of commercial asbestos is associated with lung cancer. It raises two important points. First, the relationship between cancer and asbestos has been established by actual human morbidity studies, a rare occurrence since we usually rely on animal studies to determine whether a substance is carcinogenic. But the relationship was developed by studies of a limited population, occupationally exposed to high airborne concentrations of asbestos for relatively long periods of time. These occupational studies were used to determine the health effects of normal exposure to asbestos. The health risk associated with normal low-level non-occupational exposure to airborne asbestos was inferred by extrapolating data from laboratory and occupational studies.

EPA itself points out "the validity of extrapolating from high-level exposure to low-level exposure has never been demonstrated empirically." In other words, we should be restrained in assuming that the air we breathe in our schools and other buildings is unhealthy if asbestos is present. It will always be present since it occurs naturally in the atmosphere and in the rivers and streams which provide our water supplies. In fact, I understand that one school in a western State was confronted with achieving an asbestos exposure level in the school which was lower than the level of the asbestos in the surrounding air.

I would be interested in data on the level of atmospheric asbestos exposure in the community of Casper, Wyoming, as compared to the probable exposure at Kelly-Walsh High School.

The EPA report indicated that typical indoor concentrations are virtually the same as outdoors. At some point it is necessary to be realistic.

The second critical point about current programs was raised by another comment at EPA. Their report stated that "because of limited exposure data, the risk assessment for asbestos should be viewed with caution." Two years ago, EPA said all asbestos fiber was a problem. Recent research, as reported both in Science Magazine and the New England Journal of Medicine, has raised questions about the health effects of various forms of asbestos. The science panel appearing later today will focus on this dispute.

Legitimate questions have been raised about the health effects of various forms of asbestos. We have to remember that asbestos is a commercial term for several chemically- and physically-distinct types of minerals. These minerals appear to differ in their health effect. For instance, individuals who are occupationally exposed to high levels of one mineral used as asbestos had 50 times the risk of lung disease than if exposed to another mineral used as asbestos. Perhaps after today's discussion and further peer review of research, both sides of the issue can reach a scientific consensus on the health risk of asbestos.

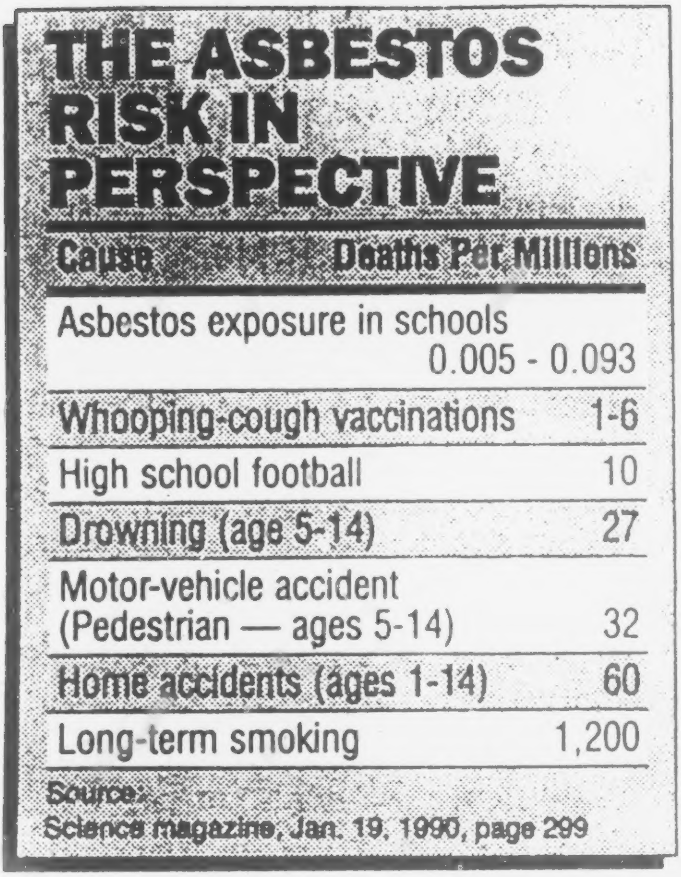
We have what is becoming a very expensive program which is seeking to reach a Utopian goal, to eliminate risk. But the world is a hostile and risky environment. We have imperfect measurements of health risk and health effect. Even Federal agencies differ on measuring health risk. As the problems at Kelly-Walsh High School demonstrate, we even need to improve the way in which asbestos is to be removed, if it is to be removed at all.

Perhaps most importantly of all, we have to determine clearly the actual risk of various mineral forms of asbestos. That brings me back to the question I raised at the beginning. Have we eliminated a risk of consequence in our environment? And is the expense worth this effort?

Mr. Chairman, that concludes my statement. I would like just to include in the record at this point a chart in Science Magazine on January 19th, 1990, which shows that the cause of death per million from asbestos exposure is 0.005 to 0.093. It is 1 to 6 for whooping cough vaccinations. It is 10 per million for high school football.

It is 27, ages 5 to 14, for drowning. It is 32 for motor vehicle accidents, 60 for home accidents, and 1,200 for long-term smokers.

[The chart from Science Magazine follows:]



# THE ASBESTOS RISK IN PERSPECTIVE

| Cause | Deaths Per Millions |
|---|---|
| Asbestos exposure in schools | 0.005 - 0.093 |
| Whooping-cough vaccinations | 1-6 |
| High school football | 10 |
| Drowning (age 5-14) | 27 |
| Motor-vehicle accident (Pedestrian — ages 5-14) | 32 |
| Home accidents (ages 1-14) | 60 |
| Long-term smoking | 1,200 |

Source:
Science magazine, Jan. 19, 1990, page 299

Senator WALLOP. My suggestion is that as you weigh all these things, we try to see if there is not some balance and perspective, because clearly, I am not one to sit here in front of you and recommend that we risk the lives of children. I am also one to say that if you cannot eliminate a risk in the process that is of significance, it is best to work on those that are significant, and perhaps ban automobiles from school parking lots.

Senator REID. Senator Wallop, since becoming chairman of this subcommittee, asbestos is something that we have worked long and hard on. It is a difficult problem, for reasons that you have partially outlined in your statement. Do you throw the baby out with the bath water in the method in which we are now proceeding? A difficult question.

The scientific community, as I'm sure we will find today, is divided on it. Typically, what legislative bodies do is bend over backwards to support the worst case scenario. In the process—and I can speak from experience in Nevada; we also closed two schools for a year each. One year a school was closed, and the students went to the other school. The next year, they reversed it. It took a year to complete each school at a cost of many, many millions of dollars and an inconvenience to about 3,000 students who went to each school, so a total inconvenience to about 6,000 students, not counting their families. So it is a difficult problem.

Tell me, just out of curiosity, this high school that you talked about is located in Casper, is that what you said?

Senator WALLOP. Yes, sir.

Senator REID. During the time that the school was closed, where did they go to school?

Senator WALLOP. It happens to be one of the few communities in Wyoming where there are two high schools. They did the same thing. They double-teamed. Some students got up at 3:30 in the morning and began their trip to school, and others returned home at 10:30 at night.

I might add, Mr. Chairman, that the students and their separate faculties and administrations were absolutely magnificent in their effort to cooperate with all of this. There was no controversy involved in the mixing of school days. There was simply a controversy as to whether or not a risk of consequence had been eliminated for that trouble.

Senator REID. Senator, you've been a member of this body for longer than I have been. One of my other responsibilities is to review the appropriation each year of the Office of Technology Assessment. It was set up by Congress and approved by the President to look into technical items, something that would take scientific abilities that the General Accounting Office doesn't have.

What would you think of the Office of Technology Assessment reviewing this for the Congress to determine, prior to reauthorizing this law, if in fact we are doing more harm than good?

Senator WALLOP. Mr. Chairman, I think it is wise. I think anything that puts us into the posture of making decisions based on facts and not emotions is highly to be desired.

Senator REID. One last question. Why couldn't this Wyoming school district receive Federal funds?

Senator **Wallop**. Because the regulation that was promulgated under that went to the issue of average local wealth. It happens to be an area where average local wealth is built on oil and gas resources, which are not available to the school system, and there was no way under the regulations that had been published that they could qualify for assistance.

Senator **Reid**. Because of the income of the people in the community?

Senator **Wallop**. Because of the distortion which often happens in a small State where you have low populations and high concentrations of natural resources. I think some of your counties may be affected quite the same way, but the regulations simply didn't go to the issue. We don't have an income tax in the State of Wyoming which could be brought into the resources, which would have qualified them, curiously.

Senator **Reid**. Senator Warner.

Senator **Warner**. Thank you, Mr. Chairman.

I would like to join you in that request to the Office of Technology Assessment. I think it's a very good idea.

Senator, you mentioned the figure of $4 million, which is substantial. Can you put it in the context of the overall budget so that we can have a better idea——

Senator **Wallop**. Of that school?

Senator **Warner**. Yes. Is it a hardship?

Senator **Wallop**. Well, it's an extraordinary hardship. It has literally caused them to forgo acquisition of learning materials and the payment of teachers. I don't have the precise relationship, but I would be happy to furnish that for the record.

Senator **Warner**. I think it would be helpful if you could provide for the record what the annual school budget is, and then what proportion $4 million represents, because you have been dramatic in describing the hardship on parents and teachers.

[Information to be supplied follows:]

The Natrona County School District No. 1, which includes Kelly Walsh High School, has a total budget for this school year of $60,442,497.86. The $4 million in asbestos clean-up costs, which part of the Kelly Walsh budget, comes out of this total school district funding.

Senator **Wallop**. I would say, Mr. Chairman—if I may, Senator Warner—that one of the extraordinary things about this is that the school learned of its obligation to shut down seven days before the school year started.

Senator **Warner**. That brings me to another line of questioning. Do you believe that the EPA needs to revise the formulas that they use to determine if a school district should receive financial assistance for asbestos removal?

Senator **Wallop**. Yes, I do, and I believe they are working on that now. I have received their promises during the Clean Air Act and the amendments that I put onto it to research that.

Senator **Warner**. Do you believe they should also revise the procedures by which they notify the school, to allow them a certain period of time in which to make adjustments?

Senator **Wallop**. Yes. And there has to be a level of common sense. Seven days—Senator Reid's example of how they had two schools that had to do their cleanup in separate years—if one is to take the posture that this is an unacceptable risk, why expose them to the unacceptable risk of one more year in that school? So there has to be some level of common sense that applies there. Surely, there was no increase in cancer noticed in that school district because all the students went to the asbestos school while the other asbestos school was cleaned up.

Senator **WARNER**. Well, is there not sufficient flexibility in the law to provide for the exercise of discretion by appropriate individuals?

Senator **WALLOP**. Well, the EPA claims there is. The school superintendents claim there is not.

Senator **WARNER**. So that's a subject we should address.

Senator **WALLOP**. It may have something to do with regional authorities at EPA. I'm not certain. All I know is that the schools in Wyoming that have had this requirement do not feel that there is any give, flexibility, or relief available to them.

Senator **WARNER**. What about the technical assistance that is available to a school district? Does the EPA provide an adequate source for technical assistance?

Senator **WALLOP**. One, I think it's inadequate. I think another thing your question raises is the point that EPA should spend a little more time in both identifying and training competent contractors. There is a lawsuit now from the school authorities against the original removal operation. Nonetheless, the cleanup created a greater level of asbestos in that school after its first attempt than existed at any time before it. As I say, the outside air is probably higher than the inside requirement in its content of asbestos fibers.

Senator **WARNER**. In your testimony you have pointed out some very interesting facts about asbestos. As I understood it, "asbestos" is a generic term.

Senator **WALLOP**. It's a commercial term, really, to apply to several different chemical structures.

Senator **WARNER**. It's generic, and within that framework there are a number of—are they elements, or compounds, or both—I guess they're compounds——

Senator **WALLOP**. I barely made it through high school chemistry. I don't want to get too far into this. I think you would better ask the people who are testifying later.

But it is my understanding that there are a variety of different physical structures which go under the name of asbestos, some of which are a great deal more threatening and carcinogenic than others, but no distinction among them is made.

Senator **WARNER**. I just think there should be adequate technical assistance available to the school districts if they desire it.

I thank the witness.

Thank you, Mr. Chairman.

Senator **REID**. That's one of the things that we will learn during this hearing, the types of asbestos, the friable and nonfriable and all that.

Senator Lautenberg.

Senator **LAUTENBERG**. Thanks, Mr. Chairman.

Senator, I know that a degree of skepticism is probably appropriate when we look at Government programs, but while you are here, I would like to ask any of those—I know Dr. Landrigan is here—is there an incubation period——

Senator **Reid**. We're not going to have them answering questions now. They can answer questions when they testify.

Senator **Lautenberg**. Well, there are so many assertions being made, Mr. Chairman——

Senator **Reid**. Well, we're going to stick with it. If you have questions of Senator Wallop, you can ask those.

Senator **Lautenberg**. I have, Mr. Chairman, if I might continue. I would ask Senator Wallop whether he is aware of any incubation period for the development of disease.

Senator **Wallop**. Mr. Chairman, one of the things I noted in the study—I think it was EPA's, but I'm not certain—was that if you were to live for 73 years, the average lifespan of Americans, in that school without graduating and without going home at night, that you would have approximately three chances in a million more of gaining a cancer than you would if you went about your ordinary life.

Senator **Lautenberg**. I thought I heard you say, however, that there was no evidence of cancer incidence in the school that suggested that it was more dangerous than any other place.

Senator **Wallop**. Mr. Chairman, there have been people going to school there for some considerable time. One of the reasons that they have it is that it was built when asbestos was used for everything.

And are you aware of studies that have been done to confirm your statement that the incidence of cancer or health hazard as a result of exposure to asbestos is different from or less than any other place?

No, Mr. Chairman, I don't think there is any study. Nobody has made the claim nor suggested that there was.

Senator **Lautenberg**. Is there a State accreditation agency that looks over contractors? Isn't there something in the State of Wyoming that says when we have people do this kind of work, that there is some liability that they incur?

Senator **Wallop**. You have several problems involved in all of this. One is the shortened time frames within which the requirements to remove or contain take place. In our parts of the world there are not all that many people who are engaged in this.

I think, honestly, that the State Department of Environmental Quality can make recommendations based on EPA's views, but I don't think that there is such a thing as a direct State accreditation agency.

Senator **Lautenberg**. We funded this program at about one-fifth of that which was originally proposed. Perhaps we ought to examine how the funds are made available to a school. I'd have to dig a little bit further to understand why it is that a school in a district in which it is suggested that the per capita income wasn't particularly high, but you very carefully alluded to the fact that there was considerable economic product developed as a result of energy opportunities——

Senator **Wallop**. In many respects, it is an export thing.

Senator LAUTENBERG [continuing]. And to your knowledge, the reason that the district couldn't get any help was because of the general economic condition of the area?

Senator WALLOP. No, to my knowledge it couldn't get any help because of the specific regulations which EPA has promulgated under the terms of the act which Congress passed.

Senator LAUTENBERG. We'll have a chance to talk to EPA on that. Thank you very much.

Senator REID. Senator Lieberman.

Senator LIEBERMAN. Mr. Chairman, I have no questions for Senator Wallop, but I would just like to welcome my colleague, now that he is here, Congressman Shays.

He and I have talked together about his concern in one part of Connecticut, particularly about this problem. I know he has done some work on it. I am sure he will bring his normal high intelligence and good will to bear on the problem.

I always go out of my way to welcome him, Mr. Chairman, because although he is not my Congressman, he is my mother's Congressman. I want that relationship to continue to be strong.

Mr. SHAYS. Thank you, sir.

Senator LIEBERMAN. Thank you.

Senator REID. Congressman Shays.

## STATEMENT OF HON. CHRISTOPHER SHAYS, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF CONNECTICUT

Mr. SHAYS. Thank you, Mr. Chairman and Senators.

Mr. Lautenberg, I am sorry I walked out as you were talking because I would have liked to have heard some of the points that you made. I know you have worked long and hard on this very important issue.

From the outset I think it's important to acknowledge that asbestos is a known carcinogen which has been linked to a rare and, at present, incurable form of lung cancer and to a debilitating lung disease known as asbestosis. Although the evidence is very conclusive on the health risks to asbestos workers and miners, there is no agreement as to what is an acceptable level of exposure to occupants of buildings with asbestos-containing materials.

The question we as legislators now face is whether Congress overreacted when it passed the Asbestos Hazard Emergency Response Act, AHERA, and whether we are not in fact creating greater health problems through this legislation. Unless we take action immediately to modify the regulations promulgated under AHERA, I am gravely concerned we may be jeopardizing the lives of our young people in the name of public health, and spending $3 billion to $6 billion doing it.

By passing AHERA, Congress required that all schools inspect for asbestos and either make it harmless or remove it. The intent of AHERA was to have trained professionals evaluate each school on a case-by-case basis to determine the proper solution to an asbestos problem. However, despite the fact that much of the asbestos remains safely encased, many school administrators feel they must remove it to comply with the law.

Out of concern for public safety and potential liability—and I want to emphasize that, potential liability—it appears that many have failed to consider alternatives to removal. Two recent studies, including a Harvard University Energy and Environmental Policy Center symposium and a January, 1990 article in Science Magazine, concluded that public fears about exposure to asbestos in schools have been greatly exaggerated. Both question the wisdom of policy that advocates the removal of asbestos. Even though the Harvard report was funded by such groups as the Safe Building Alliance, which represents asbestos manufacturers, it was prepared by a distinguished group of internationally-recognized experts and should be given careful consideration in this debate.

Both the Harvard study and the Science article argue that the level of asbestos in most buildings is very low. They also point out past studies of health risks that failed to take into account the different types and sizes of fibers. The Harvard study estimates lifetime risk of death to be around 1 in 100,000 for children exposed for 10 years.

The report goes on to say that this risk is lower than commonplace risks in our society, including exposure to radon and passive tobacco smoke. In addition, both reports emphasize the removal of previously-undisturbed asbestos may escalate health hazards by increasing the number of inhalable fibers in the air. In fact, the Harvard study cites recent data indicating the removal of asbestos frequently creates higher concentrations after removal, and post-residual asbestos can continue to pose health risks to building occupants.

A recent letter I received from the Environmental Protection Agency acknowledged that "removal of asbestos may sometimes present more hazard than leaving it in place." It further states that "removal of asbestos from buildings, although attractive in concept, is not always the best alternative from a public health perspective."

The problem is exacerbated by the fact that technical expertise on asbestos is not readily available in many towns, and the EPA has failed to provide the necessary guidance and technical advice on alternatives to removal. In addition, it is my understanding that the EPA has focused on random sampling of asbestos-containing materials and visual inspections rather than focusing on measurement of airborne fibers, which may offer a better assessment of the actual health hazards.

Since the costs involved for asbestos removal are of astronomical proportions, and since we do not know if we are causing more harm than good, I am very troubled by the Harvard study and the Science article. In my Congressional District and in Senator Lieberman's State one town—just one town—is looking at a price tag of approximately $10 million to remove asbestos from just one school. Think of the opportunity cost. Think of how this money could be better spent. This town could provide 140 of its most needy high school graduates with four years of college tuition, absolutely free.

If in two years the EPA's Health Effects Institute study concurs with recent data and determines that removing asbestos only increases the health risks, going forward now on removal projects which will cost billions is an absolute outrage.

I urge the subcommittee to examine closely the recent scientific reports—in fact, I thank you for examining the recent scientific reports, and I thank you for considering putting a temporary delay on the final implementation of removal plans until we have a better understanding of the health risks involved. At the very least, review should be done on a case-by-case basis to determine whether removal is in fact in the best interest of the children.

It is highly probable that other alternatives to removal, including relatively inexpensive encapsulation, may be cost-effective, and most importantly, safer. It is imperative EPA offer better technical advice on other asbestos abatement techniques.

I would just conclude that in addition, EPA should consider issuing advisories emphasizing that active in-place management for asbestos in schools may be preferable, both in terms of safety and cost, to removal. Schools should be dissuaded from undertaking unnecessary, costly, and perhaps even more harmful asbestos removal.

I just might say that I know you gentlemen are very concerned about this issue. My one concern is that we not be married to the past, that we think, "Well, some schools have already done it. If we now change the process or delay it, are we saying to those schools that have already done it that maybe they've wasted money?" I just hope that we are careful and do what we think is right, whatever that is.

Senator REID. Congressman Shays, you raised the question about which this committee is concerned, and that is whether removal is more harmful than not. But keep in mind what Senator Wallop said. Take the position of the school administrator and the school board. It is very difficult for them, when they find there is asbestos in a building, to explain to parents why they are not doing something about that. I think that is the key, because once it is determined that there is asbestos in a school, I am sure most parents would be very concerned because the information now, at best, is not clear, and at worst, it indicates that asbestos in a school can cause children to have cancer. True?

Mr. SHAYS. Very true. It is very true that there is uncertainty as to what the data really tells us. There is no question that parents are concerned, but I know that some parents are concerned that even the removal may in fact put their children in greater jeopardy.

Senator REID. I've heard that. As I indicated while you were gone, this subcommittee has been concerned about this for a long time. There is now no evidence to that effect, or if there is it is very confusing—that is, that removing it is more harmful than not. There is some evidence to the fact that—and we will develop this as the day goes on—that when you encapsulate it, then what do you do when you have to replace wires, for example, or drill a hole through a ceiling, as happens in a building, things like that that are just necessary? Does that mean that you have to start all over again? So it is not easy.

Mr. SHAYS. It is definitely not easy. I notice that you have some fine experts who will follow us, and I am sure that you are going to be debating that question.

But just bringing in the issues of what type of fiber, the size, and so on, I think there is a real indication that, in fact, that may be the issue.

Senator **Reid**. In light of what we have before us now in the country, parents aren't going to be very impressed with the size of the fiber.

Mr. **Shays**. Well, they should be, because the bottom line for us is what in fact is causing the diseases. That's the bottom line to us. We have to speak plainly with the parents. That's why the case-by-case review is essential, and it may require that we provide some more assistance to do that.

But it would really be an absolute outrage to spend billions of dollars and then decide later that we had made a mistake.

Senator **Reid**. Senator Lautenberg.

Senator **Lautenberg**. No questions, thank you, Mr. Chairman.

Senator **Reid**. Senator Lieberman.

Senator **Lieberman**. Just very briefly, to ask you if you would put on the record from your own understanding a little more about what the situation is in that town in Connecticut. Is that a situation where it has been determined that the asbestos is friable, and therefore may cause problems? Or is there some possibility that the school is reacting to parental concern because there has been a finding that there is asbestos there?

Mr. **Shays**. I think Senator Reid has made a very significant point, that there is asbestos in the school. The challenge is it may be almost as costly to encapsulate it, and that presents a problem.

The school was built about 20 years ago at $17 million, and now the school has estimated it will spend $10 million just to remove it.

Senator **Reid**. Is this a secret name that this school has?

Mr. **Shays**. No. It's New Canaan High School in New Canaan, Connecticut.

We're also looking at the Diocese. There are many schools throughout Connecticut. When Bishop Eagan from Bridgeport was head of the New York school system, he was able to describe in some detail the opportunity cost of spending $50 million in New York City and what that meant that he couldn't do for his school students. I know the State of Connecticut has tried, as well, to assist with the cost.

Senator **Reid**. Thank you very much for your time here today.

Mr. **Shays**. Thank you.

Senator **Reid**. Linda Fisher, would you please come forward?

We have a copy of your statement. If you could summarize it within five minutes so that we would have ample time to ask you questions, it would be appreciated.

## STATEMENT OF LINDA FISHER, ASSISTANT ADMINISTRATOR FOR PESTICIDES AND TOXIC SUBSTANCES, ENVIRONMENTAL PROTECTION AGENCY, ACCOMPANIED BY MICHAEL STAHL, DIRECTOR, ASBESTOS PROGRAM

Ms. **Fisher**. Thank you, Mr. Chairman. I appreciate the opportunity to testify before you today. With me is Mr. Mike Stahl, who is Director of the Asbestos Program at EPA, who will assist me in answering questions.

I welcome the opportunity to clarify for you today the Agency's policies to reduce asbestos exposure in the Nation's schools, and I would also like to take this opportunity to set the record straight with regard to a number of recent studies and reports regarding asbestos. Additionally, I would like to address some of the specific concerns that you have raised regarding the implementation of the Asbestos in Schools Program.

As you know, on October 22nd, 1986, President Reagan signed the Asbestos Hazard Emergency Response Act into law, under which EPA was directed to issue regulations that require public and private elementary and secondary schools to inspect their buildings for asbestos, to develop management plans, and to submit them to their States, and to implement appropriate response actions, such as in-place management, repair, encapsulation, or removal.

AHERA also required the schools to use accredited personnel to carry out these activities.

AHERA established very ambitious deadlines for EPA and the schools to implement this program. EPA was required to issue, by April, 1987, a Model Accreditation Plan for training and accrediting inspectors, planners, and abatement contractors and workers. EPA was also required to implement final regulations for the Asbestos Inspection and Management Program by October of 1987.

EPA's analysis indicates that at least 94 percent of the Nation's schools have now completed their inspections and management plans. Thus, after more than three years of hard work by EPA, the States, and the schools, a framework for managing asbestos risks in schools is now in place.

As mentioned previously, under the AHERA Program EPA was directed to issue a Model Accreditation Plan to provide training and accreditation for persons who inspect, manage, and abate asbestos in schools. We estimate that there are approximately 100,000 or more AHERA-accredited persons who are available nationally for asbestos-related work.

The Model Plan specified criteria necessary for the initial training, for examination, and for continuing education. Persons can be accredited by States, which are required under AHERA to adopt a contractor accreditation plan that is at least as stringent as EPA's plan, or by completing an EPA-approved training course and passing an exam.

We developed a system to ensure the fast, efficient, and competent review of accreditation courses submitted to EPA by private training organizations. As of February of this year, approximately 600 training providers are currently offering 1,100 EPA-approved courses for accreditation. EPA has also promoted national consistency by publishing a model course curriculum for AHERA contractors, inspectors, and planners.

We have also financed and implemented several projects in addition to our model plan that were developed to enhance the State capabilities. We have already granted to the States approximately $4 million for contractor certification programs and for inspector and management/planner accreditation programs.

Today, due in part to this seed funding and technical assistance, approximately 20 States have accreditation programs that meet the

AHERA standards for abatement contractors and workers who conduct these projects. In addition, another 27 States have some type of certification program for asbestos abatement, which can be upgraded to the AHERA levels. Of these 47 States, 42 have extended the asbestos training and certification requirement to cover asbestos abatement work in public and commercial buildings as well as schools.

As the AHERA program has progressed, EPA has begun to evaluate the effectiveness of the inspection and management regulations and the accreditation programs that we have established. A major evaluation of the AHERA program is underway, and we should begin to receive some of these results in the next six to twelve months.

Specifically, our evaluation plan will look at all phases of the program. We will look to see whether or not the inspections in schools are done properly. We will look to see what kind of quality is in our management plans and what type of information is being provided to the maintenance workers who work in the areas where asbestos most normally occurs. Additionally, we are going to look at what type of removal actions have been taken and how effective they are.

I would like now to discuss the School Loan and Grant Program established under the Asbestos School Hazard Abatement Act——

Senator **Reid**. Ms. Fisher, if you would be kind enough to hit the facts, I don't think there is time enough to go through the whole statement.

Ms. **Fisher**. OK.

Mr. Chairman, I think that the facts you are referring to lay out very clearly for you the agency's position on some of the most common misperceptions, if you will, about asbestos.

The first fact set forth in my testimony is that although asbestos is hazardous, human risk of asbestos disease depends upon exposure. Asbestos is known to cause cancer and other disease——

Senator **Reid**. Sorry to interrupt again, but if you would just hit the facts. There just isn't time to go into all of it. It's a large statement which, I would also indicate, we would like to get these statements a little earlier. The EPA always brings theirs in late. I don't know if there's anything that can be done about it, other than to say something publicly, because it doesn't give us adequate time to prepare questions.

So please, if you would just hit the high points.

Ms. **Fisher**. I appreciate that, Mr. Chairman, and we will try. EPA statements generally seem to be the more controversial ones, and therefore take longer to get through the system.

The second fact is that prevailing asbestos levels in buildings seem to be very low. Accordingly, the health risk to building occupants also appears to be very low.

Fact number three: removal often is not in a building owner's best interest, or the best course of action for a building owner to reduce asbestos exposure.

Fourth, EPA only requires asbestos removal in order to prevent significant public exposure to asbestos during building renovation or demolition. We do not require removal as part of our Schools Program.

EPA does recommend in-place management whenever asbestos is discovered. A proactive in-place management program will usually control fiber release, particularly when the materials are not damaged and are not likely to be disturbed.

I hope this addresses most of the issues that have been raised by the subcommittee, and I would be glad to answer any questions you might have.

Senator **Reid**. Let's talk a little bit about the problem that Senator Wallop mentioned, the loan program.

Ms. **Fisher**. When the agency began to implement the Loan and Grant Program, we needed to establish some criteria against which we would evaluate which schools we were going to fund and which schools we were not. The law directed us to look at two factors: the financial need of the school, and the hazard conditions in the particular school.

To set the financial criteria, the Agency for public schools has used a per capita income cutoff. The concern raised by Senator Wallop was that his particular school was in a district where the per capita income was above our cutoff, so therefore, from a financial need point of view, his school did not qualify.

Senator **Reid**. Are you looking at that as to whether or not you are going to change that or review that policy?

Ms. **Fisher**. We have had a number of circumstances where schools have been brought to our attention, that they don't qualify on the financial need circumstances as we have currently laid it out. We are evaluating whether we should have what I call an "exceptions policy," where there might be factors other than just per capita income that we might want to take into account in deciding whether a school meets the financial need test. We have just begun that process and are working within the agency. Once we have some ideas we will be moving forward to get public comment on them from other school organizations that participated with us as we established the current formula that we are using.

Senator **Reid**. Perhaps you and your associate can answer this question. If not, we will leave it to some of the experts who will follow.

If asbestos-containing material is discovered in a school and the school decides to manage it instead of removing it, won't the asbestos eventually deteriorate to the point where it will have to be removed anyway?

Ms. **Fisher**. That can only be determined on a case-by- case basis. In some instances time may, in fact, deteriorate the asbestos and ultimately lead to the need to remove it, but I think that schools need to take into account a very site- specific evaluation, take a look at where the asbestos is, whether it is in a position or a place that it might deteriorate over time, and whether that deterioration will lead to exposure.

Senator **Reid**. Don't you think, though, the question that I asked Congressman Shays is the paramount question? That is, unless we do something to change the public perception, if a school is determined to contain its asbestos, how are you going to convince a bunch of parents that it doesn't have to be removed?

Ms. **Fisher**. Senator, I think that is a very important issue, and I think a lot of schools are facing pressure from parents who are concerned that the mere presence of asbestos in the school means there is exposure, and therefore a health threat to their children.

In terms of what we can do, personally, the Agency is undertaking a lot better outreach program to educate not only the school associations, but also the PTA and other organizations that deal with parents. We are writing a number of articles that can be published in trade journals or school magazines, education brochures, to inform people of what we see as the real risks of asbestos and how they should most appropriately respond to those.

Senator **Reid**. Do you have records as to what percentage of schools, once discovering they have asbestos, remove it as compared to abating it?

Ms. **Fisher**. We have not required the schools to submit their plans to EPA. They are to submit them to the State, so I don't believe we have the information to say how many school districts, as a part of their management plans, actually require removal.

Senator **Reid**. I'll bet very few abate as compared to remove.

Mr. **Stahl**. We don't really have any good figures, Senator, but we are, as Linda pointed out, undertaking an evaluation of AHERA. One of the features of that evaluation will be to get some empirical data about how many schools are electing to remove versus how many are electing to use other kinds of abatement options.

Senator **Reid**. Over the last couple of years the EPA has been drafting guidance on managing asbestos in place. Isn't it about time we got this draft?

Ms. **Fisher**. Senator, in June of this year we will be publishing a new document that will be a very detailed description and discussion of how best to handle in-place management. We currently have information on the streets, but the document that will be coming out in the next two months will be far more factual and thorough and up-to-date. We've learned a lot in the past few years.

Senator **Reid**. In your statement you talk about the dangers of asbestos. It's an impressive statement, but what is being done to publicize your views and those of your agency?

Ms. **Fisher**. We have a number of brochures that we send out to people. We have a very aggressive mailing list, particularly with respect to schools, to educate them as to how to deal with the asbestos programs and how to react to asbestos. It does go through our discussion of the risks themselves.

In addition, we have a research effort underway with the Health Effects Institute to improve our current state of knowledge and evaluate where we are today with respect to the science. Once the Health Effects Institute completes its work we will be making that available to the public, as well.

Senator **Reid**. Senator Lautenberg.

Senator **Lautenberg**. Thanks, Mr. Chairman.

Ms. Fisher, welcome. Let me ask you at the outset, does EPA support repeal of AHERA?

Ms. **Fisher**. We do not support rescission of AHERA. More importantly, the deadlines that were imposed under AHERA have already come and gone. As I said, about 95 percent of schools have already implemented AHERA. They have done their inspections, they have developed their management plans for asbestos, and they are in the process of implementing those plans. So we don't support repealing it, but even if we did, most of it is already underway.

Senator LAUTENBERG. You heard about the Wyoming case, I'm sure. Was it EPA that recommended removal?

Ms. FISHER. No, Senator. We do not generally get into analyzing schools' individual plans.

Senator LAUTENBERG. Then someone there made their own decision?

Ms. FISHER. That's correct.

Senator LAUTENBERG. They also made the decision there as to how much they would be spending on this, correct? You didn't give them an estimate, or they didn't ask you for an estimate?

Ms. FISHER. No. They hired their own contractors.

Senator LAUTENBERG. That was a decision they made locally.

You answered the question about financial support just a moment ago.

What about loans for asbestos management programs that are now being paid off and returned to the Asbestos Trust Fund established by AHERA? I assume that is happening.

Ms. FISHER. Yes. I think we have approximately $9 million in the Trust Fund right now.

Senator LAUTENBERG. And how will EPA use this money?

Ms. FISHER. We will look to the Congress for guidance. In order for us to use it, it would have to come through the appropriations process to us. We don't have a direct authority to tap into the Trust Fund itself.

Senator LAUTENBERG. In response to the Chairman's question about publicizing your views, I take it you've thought about ways of making it clearer to school districts that AHERA doesn't mandate approval, so you'll be including that in your planning?

Ms. FISHER. That's correct. This coming month, in May, we will announce a new awards cycle, or the awards from the current cycle, and as a part of that announcement strategy we will be emphasizing to people that removal is not required, and secondly—and perhaps more importantly—not always in the best interest of the students.

Senator LAUTENBERG. Do you have an estimate on the remaining needs to implement AHERA?

Ms. FISHER. I think our estimates at the outset of the program were that it would cost approximately $3.2 billion to implement all of AHERA.

Senator LAUTENBERG. To make sure the record reflects this clearly, that's to get plans in place? It has nothing to do with recommending removal, etc. Am I correct?

Mr. STAHL. No, Senator. That estimate, which was done about three years ago, included the cost of development of the management plan, the carrying out of the inspection, and the estimated abatement costs.

Senator LAUTENBERG. How did you estimate the abatement costs? Did you include so much removal, so much in-house management, or in-place management?

Mr. **Stahl**. Yes. Basically, a model was developed that tried to estimate the percentages of those things that would occur as a result of AHERA.

Senator **Lautenberg**. But you do make recommendations, when asked, about the management process, do you not?

Ms. **Fisher**. We will provide technical assistance to schools that ask us for it.

Senator **Lautenberg**. What percentage of requests for funding and financial assistance are you now providing for schools that request it?

Mr. **Stahl**. Are you asking, Senator——

Senator **Lautenberg**. What percentage are you able to comply with? You have requests. What percentage are you able to provide?

Mr. **Stahl**. In a typical year of the Loan and Grant Program, we might give $45 million to $50 million——

Senator **Lautenberg**. As against what kind of a request level?

Mr. **Stahl**. For example, last year the original requests we received were for about $367 million. That does not include our cut at which of those schools would be qualified under the hazard and financial need criteria. When those criteria are applied, we would say that about $123 million of last year's requested costs for schools was qualified, and we gave out roughly $45 million.

Senator **Lautenberg**. About one-third?

Mr. **Stahl**. Right.

Senator **Lautenberg**. I am concerned about the factor that keeps inner city nonpublic schools with high operating costs from receiving ASHAA assistance. We discussed this before. These schools have high operating costs because of the number of disadvantaged students that they educate. S. 1893 requires that EPA consider these additional costs in making funding decisions.

Do you have a position on this provision?

Mr. **Stahl**. In fact, Senator, we have begun to look at ways that we can measure the kinds of costs that school districts are incurring because they serve financially disadvantaged students. As part of our revision of the financial need formula, which we will look at after this awards cycle, we might build that into the formula.

Senator **Lautenberg**. Thank you.

Thank you, Mr. Chairman.

Senator **Reid**. Senator Lieberman.

Senator **Lieberman**. Thank you, Mr. Chairman.

Welcome again, Ms. Fisher.

Based on your experience, let me just ask you a general question. Do you believe that up to this time, too many schools have done removal of asbestos where they could have done in-place management?

Ms. **Fisher**. Quite honestly, that's hard for us to say because we were not given a role to specifically review the schools' evaluations and management plans and make a determination of whether they came to the right conclusion or not.

As part of our total evaluation of the program we will have a little bit better feel of that in the next six to twelve months because we're going to go back and do a sampling of schools. But as I said, the schools were not required to submit their plans to us in the first instance, so it's difficult for us to say whether they've made a lot of wrong choices.

I will tell you, however, that I am concerned that schools are too quick to jump to a removal option, whether it's from pressure from parents or concerns about some kind of lawsuit or liability down the road. I am concerned that they are jumping to a removal option, and perhaps an expedited removal, which would make it perhaps even more costly, than they really would need to from just a health concern point of view.

Senator LIEBERMAN. Do you think that counsel or advice from contractors who do asbestos removal may be encouraging schools to go for the removal option unjustifiably?

Ms. FISHER. We are concerned, as I think everyone is when you put forward an ambitious program like this, that there may be some unscrupulous people out there who encourage removal when it's not really called for.

We have provided and encouraged the local education authorities to be sure that they are using accredited contractors, and secondly, to try to get recommendations from other school districts as to who the best are that they can use. We have also encouraged them to use different contractors to develop the plan than those who might benefit from the removal option so that you don't necessarily build in an incentive for the person who is doing your management plan to lead you to the most expensive opportunities.

Senator LIEBERMAN. And again, it seems to me from what you said already, your focus now is going to be on trying to make sure that the schools adequately consider options other than removal before going to removal?

Ms. FISHER. That's correct, and I am hopeful that the in-place management plan guidance that we will be publishing this summer will give people a much clearer view of what they can do to manage asbestos in place successfully.

Senator LIEBERMAN. Do you have any idea of about what the percentage is of schools in the country that have actually begun to implement their management plans?

Mr. STAHL. I think that as part of the AHERA evaluation, which we mentioned earlier, Senator, we may get some better indication empirically about how that is going. We don't have any hard estimates.

Senator LIEBERMAN. Okay. We will look forward to that information when you get it.

Thank you, Mr. Chairman.

Senator REID. Ms. Fisher, we have a lot of questions we will submit to you, and if you could get back to us with answers within the next couple of weeks, we would appreciate that.

Ms. FISHER. Certainly. [See p. 83.]

Senator REID. Thank you very much for your time and patience and your help here today. You've been most helpful on this issue generally.

Ms. FISHER. Thank you.

Senator REID. We would ask now that our next panel of witnesses come forward. Each of you gentlemen will issue your statement, then we will ask questions of the group as a whole: Mr. Henry Lee, Executive Director, Energy and Environmental Policy

Center, Kennedy School of Government, Harvard University; Mr. Richard Lemen, Assistant Director, National Institute for Occupational Safety and Health, Centers for Disease Control; Dr. J. Bernard L. Gee, Professor of Medicine, Yale School of Medicine; and Dr. Philip Landrigan, Chairman, Department of Community Medicine, Mount Sinai School of Medicine.

We will proceed first with Mr. Henry Lee.

We would also ask that you keep your oral statement to five minutes. Your full statement will be made part of the record.

## STATEMENT OF HENRY LEE, EXECUTIVE DIRECTOR, ENERGY AND ENVIRONMENTAL POLICY CENTER, KENNEDY SCHOOL OF GOVERNMENT, HARVARD UNIVERSITY

Mr. Lee. Thank you, Mr. Chairman.

First of all, I would like to say that I am not one of your "eminent scientists" that you have here today. I have spent most of my career in the field of environment and energy policy. I was one of the four authors of the Harvard symposium on the health risks of asbestos in buildings, which brought together approximately 40 of the top scholars and experts in this field.

I would like to quickly make two points related directly to that symposium, and then to comment on the issues you've raised in this hearing.

First, risks are directly related to exposures. The greater the exposures, the larger the risks. The majority of studies indicate that an occupant of an average building containing in-place asbestos is exposed to levels of asbestos fiber which are not much higher from those which they would encounter outside. The risks to these individuals is very low. However, individuals who are in the asbestos removal business, or in some cases people who are in the custodial or building service industries, are exposed to much higher levels. For these people, the health risks are much greater.

If you are in the risk reduction business, it is to this segment of the population that you want to focus your attention.

Senator Reid. Could you give examples?

Mr. Lee. People who are in cabling, i.e., putting cables through ceilings, people who are in custodial jobs, i.e., maintaining HVAC systems things like this.

Senator Reid. Okay.

Mr. Lee. Second point, the act of removing asbestos from a building may, in certain circumstances, exacerbate exposures and thus increase risks. Studies of post-removal—and I may say, these have not been many studies, but the studies that have been done—have found concentrations of airborne fiber levels which are much higher than those present prior to removal.

What should Government do? Congress and EPA should base their asbestos policies on a firm foundation of scientific fact and should utilize those facts to determine the actual risks to various segments of the population. Programs should be targeted at those populations where the risks are greatest, and those programs should be designed in the most cost-effective manner possible. Let your risk reduction goals drive your program, and do not let your specific implementation strategies set your goals.

Second, increased Government efforts should be directed at those populations which are at greatest risk from exposures to asbestos fibers. The primary group that falls within this category are asbestos removal workers. By definition, these individuals are consistently exposed to friable asbestos materials. Government agencies should ensure that these men and women receive proper training, equipment, and working conditions.

The next most vulnerable or exposed group are service personnel who, in the conduct of their job responsibilities, sometimes accidentally disturb asbestos or who inadvertently come in contact with previously disturbed asbestos material. While these exposures may be episodic, their risk is certainly higher than those for general occupants. Therefore, a reasonable asbestos management program should focus on informing these workers where asbestos material is located, what procedures to take to avoid disturbing in-place asbestos, and what precautions are necessary if and when that asbestos is disturbed.

Third, large-scale asbestos removal efforts carry with them large fiscal and environmental costs. It is ironic that actions taken to reduce a threat to public health, i.e., removal of asbestos material, can in certain circumstances increase rather than decrease those risks. I agree that in some instances removal may be necessary. However, if there is any doubt whether or not public health will be improved by removal, it is wise to proceed cautiously and to look toward other management strategies to cope with asbestos in place.

Finally, public anxiety cannot be ignored. It is very real. You can't just say that schools are not mandated to remove asbestos. This is insufficient. Government must take a more proactive approach. It must do a better job of reducing the anxieties and fear. If we find that good science does not support these fears, I would urge Government to establish guidelines for school superintendents and other building managers which explicitly describe both the dangers and the benefits of asbestos removal.

I will be glad to answer questions when it comes time for them.

Senator Reid. Mr. Lemen.

## STATEMENT OF RICHARD LEMEN, ASSISTANT DIRECTOR, NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH, CENTERS FOR DISEASE CONTROL

Mr. Lemen. Thank you, Mr. Chairman, members of the committee, Mr. Lieberman. I am pleased to testify on the science and the health effects caused by exposure to asbestos. I am currently Assistant Director of the National Institute for Occupational Safety and Health, and am a Captain in the Regular Corps of the United States Public Health Service.

I have been involved with the study of occupational and environmental exposures to asbestos since 1970. I am also the primary author of the NIOSH-recommended standard for occupational exposure to asbestos, the asbestos monograph published by the International Agency for Research on Cancer, and numerous articles on asbestos in the scientific literature. I have attached a copy of my complete curriculum vitae.

Asbestos is a generic term referring to a group of naturally-occurring fibrous minerals that are commercially prized for their thermal and insulating properties, in addition to their flexibility, durability, and tensile strength. Because of these characteristics, asbestos is highly persistent in the human body, once inhaled or ingested.

Based on studies of workers who were heavily and regularly exposed to asbestos before general Government regulation of the workplace, we know that asbestos causes specific diseases, such as asbestosis, an irreversible and progressively disabling lung disease which impairs breathing; and mesothelioma, an invariably fatal cancer of the lining of the chest and the pericardium, or abdominal cavity.

Asbestos is one of the leading causes of lung cancer in non-smokers. Asbestos exposure for smokers increases the risk of lung cancer approximately 55 times that of those who are not exposed to asbestos and who do not smoke. Asbestos is also associated with an increased risk of gastrointestinal and other cancers.

The conclusion drawn by many experts in this and other countries and best summarized in the 1987 supplement of the World Health Organization's International Agency for Research on Cancer—and it is stated in my testimony, which I will paraphrase now—is that all forms of asbestos can cause asbestos-related diseases.

Recent reports have appeared in the scientific literature to suggest that different forms of asbestos are not equally pathogenic. However, there is a great deal of uncertainty associated with these findings, and equally important contradictory evidence. Results from research involving animal bioassays present a strong case that there is no safe form of asbestos. Wagner et al., then with the United Kingdom's Medical Research Council, have shown that a commercial grade, predominantly short-fiber Canadian chrysotile, a purportedly less hazardous form of asbestos and an ingredient used primarily in paint and in plastic tile fillers, induces mesotheliomas when injected intrapleurally into rats, and induces primary lung neoplasms in rats exposed by inhalation. Not only has chrysotile been found to be as potent as crocidolite and other amphiboles in inducing mesotheliomas when injected intrapleurally, it has been found equally potent in inducing pulmonary neoplasms through inhalation exposures. Chrysotile also appears to be more potently fibrogenic and carcinogenic than amphiboles in relation to the quantity of dust which is deposited and retained in the lungs of rats.

There is the hypothesis that chrysotile is less hazardous because of its chemical and biological reactivity. In fact, chrysotile fibers are much more chemically and biologically reactive than amphibole fibers. In contact with body tissues, Chrysotile fibers lose their structural elements and divide into small fibrils, making their recognition difficult by the usual analytical methods. In fact, many of the fibers are removed from the lungs to other organs in the body and up through the bronchi. These findings also support the hypothesis that chrysotile fibers cause cellular injury, fibrosis, and lung cancer. These fibers are less readily detected in the tissues after the damage is done. The concentration of dust in the lungs of rats exposed to Canadian chrysotile was only 1.8 percent to 2.2.

percent of the dust concentration in the lungs of animals exposed to amphiboles after 24 months of inhalation exposure, yet the lung tumor incidences and degree of pulmonary fibrosis were similar among groups of rats exposed to different forms of asbestos.

At this time, there is no compelling evidence to justify different public health policy for different asbestos fiber types. The reason for higher incidence of lung cancer and mesothelioma in workers exposed to amphiboles is probably related to higher concentrations of respirable fibers during their exposures. Furthermore, most commercially exploited deposits of chrysotile are contaminated with some type of amphibole form of asbestos.

Other international expert groups have reached similar conclusions regarding the uncertainty of the hypothesis that some forms of asbestos may be less hazardous, as stated in my testimony.

Finally, the Centers for Disease Control through NIOSH has recently submitted to the Occupational Safety and Health Administration, on April 8th, 1990, a reiteration of its previous testimony of June 21, 1984, that "there is no safe concentration for exposure to asbestos." Not even the lowest exposure limit for asbestos could assure all workers absolute protection from exposure-related cancer. OSHA projects that at the current occupational standard for asbestos of 0.2 fibers/cc over a working lifetime, 67 cancers for every 1,000 exposed workers can be expected to develop. In the April 8th, 1990 submittal to OSHA, CDC through NIOSH also reaffirmed its position that there is no scientific basis for differentiating between types of asbestos fibers for regulatory purposes. The scientific evidence to date suggests that fiber morphology— that is, the size and shape—is the most critical factor in the pathogenicity of the material and as such the most prudent public health policy is to regulate asbestos based upon its morphology and not on its mineralogic source.

I would be happy to answer any questions the subcommittee may have, and thank you for the opportunity to appear here today.

Senator **Reid**. Dr. Gee.

## STATEMENT OF DR. J. BERNARD L. GEE, M.D., PROFESSOR OF MEDICINE, YALE SCHOOL OF MEDICINE

Dr. **Gee**. Thank you for the invitation to testify today. I am a Professor of Medicine at Yale.

In 1971 I supported the lowering of the OSHA standard editorially in the New England Journal, and once testified somewhat slightly north of the Delaware on behalf of asbestos abatement workers, long before that term was actually used. However, recently I have largely served as a witness for defense counsel in asbestos manufacturing cases.

I am the co-author of——

Senator **Reid**. Did you testify before you wrote your article?

Dr. **Gee**. I have testified both before and after. My original views on this were formulated about 1985, before I ever testified for defense counsel.

Asbestos in the workplace was indeed a very serious cause of morbidity and premature deaths from both insidious lung fibrosis and malignant respiratory disease. I share the concerns expressed by Senator Lautenberg, that that history is real and needs to be regarded with great caution.

But I would submit to you gentlemen that it is reasonable to totally readdress this situation on the basis of the facts that I endeavor to draw before you.

I would like first to discuss each of the diseases in some detail in relation to asbestos levels, and we will first deal with asbestosis, or lung fibrosis.

It is my understanding that at OSHA levels of 0.2 f/cc in the workplace, it is anticipated there will be no asbestosis. At levels of 1/200th of that, which is the current building airborne level, asbestosis should not be expected in the general population.

Secondly, lung cancer. Unfortunately, the data on asbestos in non-smoking subjects is in fact sparse, because there aren't very many. Indeed, in Dr. Selikoff's series, only four of 470 were in fact non-smokers—that is, asbestos workers who died of lung cancer. That, however, does serve to highlight that the voluntary risk of smoking remains quantitatively enormous in comparison with the relative size of the involuntary risks associated with societal asbestos exposure.

And with regard to that second societal point, which is clearly of concern to this committee, I would draw your attention—as you will find in the appendix—to a recent article from Austria which actually makes predictions on the risk rate of asbestos-induced cancers at certain fiber concentrations, that that risk is exceedingly small. I would point out that there are many such studies, and they are cited in the Science and New England Journal articles.

My third point that I want to raise concerns mesothelioma. Of course, this is of concern because school children are at risk because they live long enough to get it. However, it is my belief—and I have set forth the basis for this—that there is a difference between fiber types, and I have said it in three ways.

I have first pointed out that in the non-occupational setting—and in your appendix you will find a graph that shows something like the Federal budget for males and something very different for ladies; in other, no increased mesothelioma rates in women who are not occupationally exposed, in contrast to very large ones in occupationally-exposed men.

Secondly, and you will find these tables, which I freely admit are adapted and epidemiologically criticizable, but they still give in broad brush that the incidence of mesothelioma as a percent of total deaths from chrysotile is about two-tenths of a percent. Once amphiboles start to get in, mesothelioma rises as high as seven percent. That's a 15-fold difference. I really do submit that on epidemiological grounds there are substantial differences between these fibers.

One last comment. Dr. Wagner's name, as we discussed, has been quoted here. He is undoubtedly able to express his own opinions, but they might not be those of my colleague here on his own data.

Finally, I would like to just quote the ending of a Connecticut article, Senator Lieberman, which comes from New Canaan, this mysterious place, which if we stop abating asbestos might indeed be New Canaan, where they simply state that they really do have an enormous financial problem. The editorial says—and you may not agree—"It is the law, in all its environmental zeal, that is flawed."

Thank you.

Senator REID. Dr. Landrigan.

## STATEMENT OF DR. PHILIP LANDRIGAN, M.D., CHAIRMAN, DEPARTMENT OF COMMUNITY MEDICINE, MOUNT SINAI SCHOOL OF MEDICINE

Dr. LANDRIGAN. Thank you, Mr. Chairman and Senators. I am pleased to be here before you today.

I am a pediatrician. I am also a board-certified specialist in occupational medicine.

Senator REID. That's a strange combination, isn't it?

Dr. LANDRIGAN. Yes. I've become interested in recent years in child labor. I reckon it's the fusion of the two.

Senator REID. Seriously?

Dr. LANDRIGAN. Yes, sir.

Senator REID. I'll be darned.

Dr. LANDRIGAN. I testified before Mr. Shays on the House side not long ago on that subject.

Senator REID. That's very interesting.

Dr. LANDRIGAN. I have been Past Chairman of the Committee on Environmental Hazards of the American Academy of Pediatrics, and I have before me a report on asbestos exposure in schools from the Academy which I would like to submit for the record when I'm done.

Also, I am Chairman of the State of New York Asbestos Advisory Board, and I have a copy of our most recent annual report. I would like permission to submit that for the record.

Senator REID. We will accept them for the file of this hearing.

Dr. LANDRIGAN. Thank you, sir.

I would like to begin by very briefly reiterating what has already been said by my colleagues about the hazards of asbestos. There is simply no question that asbestos is a powerful carcinogen, that it can cause lung cancer, that it can cause mesothelioma, that it can cause a host of other tumors.

It is estimated that by the end of this century there will have been between 30,000 and 50,000 premature deaths in my State of New York alone as the result of past occupational exposures to asbestos. That means that across the country we estimate there will have been between 300,000 and 500,000 premature deaths due to past occupational exposures to asbestos. We're not talking here about a trivial problem.

Senator REID. Over what period of time will these people die?

Dr. LANDRIGAN. Those, sir, are deaths that will occur by the year 2000 as the result of exposures which occurred prior to 1980. Those numbers, therefore, don't include any additional deaths that may result from occupational exposure since 1980, nor do they reflect any deaths that may result from exposure to asbestos in schools or other buildings.

With regard to the issue of asbestos in buildings, the problem is very widespread. A city-wide survey or census of buildings was done in New York in 1988. Nine hundred buildings were sampled.

Two-thirds of these 900, or approximately 600, contained asbestos, which was in good condition in 13 percent of the buildings, in fair condition in 68 percent, and in poor condition in the remaining 19 percent. The building stock in New York is probably a bit older than in some other parts of the country, but it certainly illustrates that the problem is not limited to a few buildings.

I would like to pose the rhetorical question, what is the hazard of asbestos in buildings? The Academy of Pediatrics in 1987 reviewed very closely the estimates that the Environmental Protection Agency had put forth in regard to the number of today's school children who might ultimately be expected to die from lung cancer and from mesothelioma as a result of their exposure to asbestos in the schools now. We reckon that over the next 30 years that there will be approximately 1,000 deaths, somewhere between 100 and 7,000 excess deaths from lung cancer and from mesothelioma in today's school children as they grow up. Sure, in any one school district there may only be one or two such children, but all of these are unnecessary, preventable deaths. When one looks at the problem across the breadth of the United States, again, it is not trivial.

I, too, would like to comment briefly, and in more detail in my written testimony, on the issue of the different fiber types. I subscribe absolutely to the position that was laid down by my former colleague in the Public Health Service, Mr. Lemen, that all of the various types of asbestos must be considered to represent an equal hazard in terms of their human carcinogenicity. I would like very briefly to touch on four points which I believe support that point of view.

First of all, in Quebec, where most chrysotile that is used in the United States is mined, there have been 67 cases of mesothelioma, the almost invariably fatal tumor that results from exposure to asbestos. This observation, which tends to be dismissed by my colleague, Dr. Gee, and his co-authors in their well-known articles, is a fact. It's a matter of fact that there have been 67 deaths from asbestos in these miners. Whether or not the cases of mesothelioma that have occurred in these miners are due to the chrysotile or to trace elements that may be in the chrysotile is really of no moment. It is of no import because those trace elements, whatever they may be, are not removed from chrysotile when it is distributed in the marketplace. So it is really of no consequence to split the issue in that direction.

Also, in epidemiologic studies that have been undertaken by the U.S. Public Health Service and various academic groups, looking at populations exposed to various mixes of asbestos fibers, including one study that was done by Mr. Lemen, there has been little difference in the rates of lung cancer, whether the proportion of chrysotile was 98 percent, 90 percent, 60 percent, or 40 percent. That series of observations is just not consistent with the notion that the different fiber types convey different hazards.

Also, the various fiber types show little measurable difference in hazard in regard to the incidence of mesothelioma.

Finally, in animal studies the various fiber types show little difference. In fact, in some of the studies chrysotile asbestos has actually been shown to be more highly carcinogenic to animals than the other types.

Senator **Reid**. I think we're going to go to the questions now. Your time expired some time ago.

Dr. **Landrigan**. Fine. Then I would be happy, in the questions, to answer the questions on risk, and also on remedy, sir.

Senator **Reid**. What we're going to do, gentlemen, is keep ourselves to five minutes each for questions and then come back for a second round if need be.

Dr. Landrigan, how do you come up with such a different opinion than Dr. Gee?

Dr. **Landrigan**. Well, sir, I think that what I've tried to do in my analysis of the epidemiologic literature on asbestos—and I'm a fully trained epidemiologist at the Centers for Disease Control and board-certified in that specialty also—I have attempted to relate the risk of disease in populations of exposed workers, to put that risk on a per-fiber basis. In other words, rather than look at huge populations, such as all men and all women, among whom there is obviously great heterogeneity of exposure, what I have attempted to do in my analyses is to express risk on the basis of the number of tumors per fiber of exposure per year of exposure. When one does this sort of analysis, the rates of disease come out to be very comparable for all fiber types.

This information is portrayed in considerable detail in a letter which we have submitted to and been accepted by Science, the same journal discussed earlier.

Senator **Reid**. We would make that part of the record, too. [See p. 276.]

Dr. **Landrigan**. Thank you, sir.

Senator **Reid**. First of all, being an old trial lawyer and getting older every day, I have to tell you that you are suspect when you partially earn your living by testifying for asbestos manufacturers. Have you testified on behalf of alleged victims?

Dr. **Landrigan**. No, sir. In the case of asbestos, on neither side of the issue.

Senator **Reid**. Okay.

Now, Dr. Gee, you tell me how you come up with a different conclusion than Dr. Landrigan.

Dr. **Gee**. I would be happy to do this.

The first thing I would like permission to do is to incorporate into the record the response of the authors to Dr. Landrigan's letter to Science, which I have, of course, seen by now. [See p. 278.]

Senator **Reid**. Fine. That will make the record complete.

Dr. **Gee**. Thank you.

The second response I would like to make is that lest it be thought that I, being the coauthor in this, am the only upstart to make these outrageous suggestions, I would quote to you that a number of other nations of presumed sagacity take the same view. One is north of the border, that is, Canada; one is Germany; and one is the United Kingdom.

Senator **Reid**. You say that they, as a country, take this view?

Dr. **Gee**. I say that asbestos guidance and review commissions take the position that I have expressed, so I am not a total upstart in this regard.

With respect to the concerns that I think are being expressed over fiber type and over the minute number of fibers required to produce mesotheliomas, I should quote Sir Richard Doll, whom I think most of us would agree is probably the world-renowned cancer epidemiologist who unquestionably supported these views as written statements in the course of responding to EPA position papers, which I think your committee should review. They go back a number of years. He has also published similar documents.

As regards Dr. Landrigan's points about fiber counts, I am sensitive to what he says, but I respectfully submit that that data will not be more than marginally changed were we able to accurately determine those, which in general we are not, only in the very grossest of terms.

It is indeed also important to recognize that although animal experiments are important, the ultimate test of risk has to be in man with known fibers of a known size. That data, I believe, is now present and available.

Thank you.

Senator REID. Mr. Lee, there have been charges that only experts acceptable to the asbestos industry were invited to participate in the Harvard Symposium on Health Aspects of Exposure to Asbestos in Buildings in 1989. How do you respond to that?

Mr. LEE. I have heard those charges. We invited a broad spectrum. A number of the people who disagreed with the views that were present in our summary were invited and did not come. I would be glad to make available to the committee the letters of invitation to those individuals. Also, I would point out that forty experts attended the meetings, including staff from this committee. The vast majority of which have no affiliation with the asbestos industry.

Senator REID. That would be good.

[Mr. Lee supplied the following information:]

EEPC

HENRY LEE
EXECUTIVE DIRECTOR
(617) 495-1350

ENERGY AND ENVIRONMENTAL POLICY CENTER
HARVARD UNIVERSITY • JOHN F KENNEDY SCHOOL OF GOVERNMENT
79 JOHN F KENNEDY STREET • CAMBRIDGE, MASSACHUSETTS 02138

The Honorable Harry Reid
United States Senate
SH-324 Hart Senate Office Building
Washington, DC 20510-2803

May 4, 1990

Dear Senator Reid:

At your asbestos hearing on April 26, you asked me whether we had limited attendance at the Harvard symposium to people favorably inclined to the industry.

There have been a number of charges about the credibility of the symposium, and I would like to take the opportunity to set the record straight.

Harvard received an unrestricted grant from four trade associations -- the National Association of Realtors, the Institute of Real Estate Management Foundation, Urban Land Institute and the Safe Buildings Alliance. In accepting these grants, we made it clear to the sponsors that they would have no control on either the agenda, the participants list, or the contents of the reports and presentations that emanated from the symposium. We made a decision to invite serious scholars working in this field, and we tried to get a broad breadth of opinion and viewpoint. Unfortunately, several individuals whom we invited either could not come or, in one instance, withdrew at the last minute.

The symposium itself was attended by approximately 40 individuals, and the summary document that we produced represented the thrust of three days of discussion. One would be hard-pressed to argue that all forty of these individuals were predisposed in favor of the asbestos industry. Finally, the four authors of the symposium summary have never individually received a penny from the industry, and the Energy and Environmental Policy Center, the sponsoring organization at Harvard, has no plans to seek future funding from any asbestos industry company or association: in other words, neither the Center nor the individuals involved have any on-going conflict of interest regarding this issue.

In retrospect, I wish we had obtained one or two additional sponsors unrelated to industry trade groups, and I wish that we had been more successful in attracting scholars who held views divergent to those expressed in our report.

I realize that to impugn the integrity of a report can be an effective way to undercut its credibility. But I hope the Committee will look at the substance of the arguments and the quality of the research documentation that lie behind those arguments.

I am not trying to claim that we have all the answers and that the highly qualified scientists at Mount Sinai are wrong. Honest people can disagree. I am simply saying that the notion that our results were in any way influenced by the source of our funding or by representatives of the asbestos industry is simply wrong.

I appreciate the opportunity to set the record straight, and if I can provide you with any additional information, please let me know.

Sincerely yours,

Enc.

List of Individuals involved with Symposium:

**SPEAKERS**

Dr. Demetrios Moschandreas
IIT Research Institute
10 West 35th St.
Chicago, IL 60616

Telephone number:
312-567-4000

Dr. Brooke Mossman
Department of Pathology
University of Vermont
Medical Alumni Building
Burlington, VT 05405

Telephone number:
802-656-2210

CANCELLED

Dr. William Nicholson
The City University of New York
Department of Community Medicine
Mount Sinai Medical School
New York, New York 10029

X

Telephone number:
212-241-7831
212-241-5822

Dr. Julian Peto
University of Oxford
Cancer Epidemiology &
Clinical Trials Unit
Institute of Cancer Research
Sutton, Surrey
Oxford, England SM2 5PX

Telephone number:

Dr. Peter Lees
Johns Hopkins University
615 N. Wolfe St.
Baltimore, MD 21204

Telephone number:

Dr. Janet M. Hughes
Tulane University
Medical School

New Orleans, LA 70112

Telephone number:
504-587-7334

---

Dr. Mort Corn
Johns Hopkins University
615 N. Wolfe St.
Baltimore, MD 21204

Telephone number:
301-955-3602

---

Dr. Douglas Liddell
McGill University
Department of Epidemiology &
Biostatistics
1020 Pine Ave. West
Montreal, Quebec, Canada H3A-1A2

Telephone number:
514-398-6264

---

Dr. Ed Peters
Arthur D. Little, Inc.
25 Acorn Park
Cambridge, MA 02138 (02140?)

Telephone number:
617-864-5770

---

Dr. Arthur Langer
(home) 6 Rochambeau Drive
Hartsdale, New York 10530

Telephone number:
212-621-9854
(h) 914-428-3667

---

Dr. Donald Dewees
Department of Economics
University of Toronto
150 St. George Street
Toronto, Ontario, Canada M5S 1A1

Telephone number:
416-978-5441

---

Mr. Smith, Research Scientist
Georgia Institute of Technology
O'Keefe Building
6th and Fowler
Atlanta, GA [illegible] (for Dr. [illegible])

## SPEAKERS WHO DECLINED

Dr. Carl Shy
University of North Carolina X
Epidemiology Department
Chapel Hill, NC 27514

Telephone number:
919-966-4181

Dr. Martin Halper
Director of Exposure Evaluation
USEPA X
401 M Street, S.W.
Washington, D.C. 20460

Telephone number:
202-382-3866

Dr. John M. Dement
NIEHS
P.O. Box 12233/MD-2-09 X
RTP, NC 27709

Telephone number:
919-541-5141

Dr. Gary Burdett
Georgia Institute of Technology
O'Keefe Building
Room 038 X
6th & Fowler
Atlanta, GA 30332

Telephone number:
404-894-3806

Senator **Reid**. Mr. Lemen, how precisely would you determine whether there's a safe concentration for exposure to asbestos? Is it something that could ever be proven?

Mr. **Lemen**. With the analytical methodology that we have today, it would be very difficult to prove that, given the various susceptibilities of different individuals to the fibers. That's why we draw the conclusion that we cannot determine with presently available scientific methodology a safe level, and therefore we recommend that no exposure to asbestos is the only way to prevent asbestos-related diseases from occurring.

I would suggest that the lower the exposure, the lower the risk of developing disease, however.

Senator **Reid**. Dr. Landrigan, why do you think that other countries accept a distinction between chrysotile and amphibole asbestos? As you have talked about and as has been talked about here today, how do they make a distinction between the two different types of asbestos when calculating health risks?

Dr. **Landrigan**. First of all, there is more to the story. For example, the Canadian Royal Commission, which I believe Dr. Gee was quoting, concluded that textile manufacturing with chrysotile should be banned, and concluded further that all fiber types can cause all asbestos-related diseases. The World Health Organization and the International Agency for Research on Cancer—certainly impartial bodies—have concluded that all types of asbestos be considered, dealt with, treated as if they were human carcinogens, and that they be dealt with equally in that regard.

There is always room, Mr. Chairman, for disagreement among scientists on this sort of an issue. I can quote one set of studies, and Dr. Gee and his colleagues can take the same data and look at them differently. There is a public health issue here, though, that goes beyond this slicing of the issues, and that's the following.

If there is reasonable basis, testified by many impartial experts, to believe that all types of asbestos fiber are equally harmful to our children, then I think it ill behooves us to make these fine distinctions that may result in many hundreds of unnecessary deaths.

Senator **Reid**. Senator Lautenberg.

Senator **Lautenberg**. Thanks very much, Mr. Chairman.

Dr. Gee, Dr. Landrigan has testified that the American Academy of Pediatrics projects, over the next 30 years, approximately 1,000 deaths from mesothelioma and lung cancer will result among the persons in the United States exposed to asbestos in school buildings when they were school children. It's a broad range of cases.

Do you disagree with their forecast or, if you will, the conclusion that they come to?

Dr. **Gee**. I have not specifically examined that and would prefer not to make a specific comment without notice.

There is one point I would like to stress, however, that I think bears very much on that. The distinction between lung cancer and mesothelioma is critical in this regard. It is my judgment that it is only in regard to mesothelioma that the distinction between fibers matters, and that matters for the children and it matters for the discussion about mesotheliomas.

For lung cancer, it is the dose of the fiber and the risk and hazard of smoking that is far more important. I think it important to distinguish the diseases.

Thank you.

Senator **Lautenberg**. Taking credit as a virulent anti-smoking legislator, having gotten rid of smoking in airplanes and various other places and trying now to raise the cigarette purchase age to 18 is among other accomplishments, but when I look at this and hear this debate among eminent scientists, giving everybody at the table credit for eminence, the question about the 1,000 lives—it doesn't sound like a lot, does it, over 30 years? And I think a point was made by the earlier panel that you can't live in a no-risk society, and what's the cost for eliminating risk. Is that an argument that buys any accreditation here?

Dr. **Landrigan**. Senator, I'd like to answer that by putting those numbers into an ethical context because it's just not right to compare the risks of asbestos with the risks of driving a car. I think when you compare risks it is important not to compare the asbestos risks to children, which are entirely involuntary—children have to breathe when they're in school—with voluntary risks like playing football, like riding a motorcycle. It is necessary instead to compare these risks with other risks which have been regulated by EPA and other regulatory agencies.

When you put things into this context, the standard of one excess death per million, which the EPA has chosen as the criterion of risk, a standard that really goes back to the 1976 Supreme Court decision on benzene, is approximately the same standard that the EPA has used in regulating other known carcinogens, such as aflatoxin, such as formaldehyde. In other words, the EPA is not taking a position here on asbestos which is grossly out of line with the stance that they have taken on other comparable issues. I think that perhaps is a better way to frame the question.

Senator **Lautenberg**. Mr. Lee, you showed some body language on that question. What's your response? I know if it was my kid, 1 in 10 million would be too many. I saw this morning's pictures on the results of Chernobyl. I've been to the Soviet Union. You see how pathetic it is. These children have a very grim future, and one which, if not short-lived, is disabled in so many ways.

Mr. Lee.

Mr. **Lee**. I think that if society had the resources to eliminate all environmental health risks, it would be a wonderful thing. But a society's resources are limited. If you look at relative environmental health risks and you put general exposure to asbestos fibers by building occupants on that list—and you compare that risk to problems such exposures to lead pollution or air-toxics you would conclude that there are many other environmental hazards which are far more serious than exposure to asbestos in buildings.

Therefore I think you have to is focus your attention on where the hazards are greatest. You take, for example, the case of asbestos. The danger to asbestos removal workers which I mentioned in my testimony, are far more serious than the dangers to general building occupants. The focus of government programs and expenditures should be helping those people who are at greatest risk and greatest exposure. I think that should be a rule for all our environmental health programs.

Senator LAUTENBERG. I think Dr. Landrigan brings up an important point, and that is, what's the ethic of the situation? Here we're debating this question, somewhat removed from this panel, about how much should society put into a dialysis machine or an individual piece of equipment to keep one person alive at everybody's expense. It's a very tough ethical question. But when it comes to our children, whether they're in Wyoming or New Jersey or the State of Connecticut——

Senator REID. How about Nevada?

Senator LAUTENBERG [continuing]. And Nevada, because I know Senator Reid is a very good and caring individual and father, but the fact is that we want to protect those kids.

The diversity of this argument, Mr. Chairman, is distressing to me because I sit here with people who have great credentials, and we get this wide divergence of view.

I would rather err on the side of safety. When we consider what the costs might be in relation to the school population, we're talking about peanuts. If we can do some good, I'd certainly like to do it.

My time is up. I thank you, Mr. Chairman.

Senator REID. Senator Lieberman.

Senator LIEBERMAN. Thank you again, Mr. Chairman.

The Chairman will remember when he and I and others were involved in the investigation of the use of pesticides on the food supply, particularly Alar. We were concerned when we learned that some members of the Scientific Advisory Board of EPA, at the same time as they were passing judgment on those chemicals, had been retained by the chemical industry, some simultaneously, some before, some after. That really complicates the problem that Senator Lautenberg just referred to, about how those of us who are not scientists can evaluate the scientific testimony that is brought before us.

In that regard, Dr. Gee, I appreciate the fact that you disclosed at the beginning of your statement that you have testified for the defense in these asbestos cases, and respectfully to you, I feel obliged just to ask you a few more questions for the record in this matter.

Dr. GEE. Please do.

Senator LIEBERMAN. One is, has any of the research that you've done that is the basis of the articles you've written been supported by institutions in the asbestos industry?

Dr. GEE. Never, sir.

Senator LIEBERMAN. I appreciate that. Then could you answer generally what the types of cases were in which you testified for the defense?

Dr. GEE. I am glad you asked this. It enables me to make what I think is the key point.

The majority of what I have done is to review medical records on behalf of such counsel. In those letters, a large number are clearly identified to defense counsel as having asbestosis, mesothelioma, or other asbestos-related disorders, and they use that in the course of their discussion with plaintiff's counsel.

Those letters are deliberately sent out ahead, without any discussion with any counsel of any kind. They are the substance of what I have read and reviewed, radiologically and in the record.

Senator **Lieberman**. So these would have been cases where, for instance, a worker would have been suing an asbestos manufacturer for a claim related to asbestosis that he has?

Dr. **Gee**. They have been that. Just for the record, I have also done quite a bit on the other side, though I want it to be statistically clear that the majority has been for the defense. But there are indeed such records.

Senator **Lieberman**. So you would be reviewing the individual records of the plaintiff in that case?

Dr. **Gee**. It would be the plaintiff's record, and I would render an opinion which would form a basis for discussions for settlement. And perhaps, since we both have an affection for Connecticut, I would tell you, I have never testified yet in Connecticut because they, in fact, are resolved as often as not on the basis of the letters, which I think are respected.

Senator **Lieberman**. I see.

Dr. **Gee**. I'm glad you asked me this, Senator.

Senator **Lieberman**. I appreciate your answer.

In his testimony that he submitted today, Dr. Landrigan indicated that he felt there was a shortcoming in your analysis in that you ignored the fact that chrysotile asbestos fibers can disappear from lung tissue prior to a post mortem analysis, so it would be technically possible for there to have been a cancer caused by those fibers, but nonetheless it would not have appeared in the tissue after death. I wonder how you respond to that.

Dr. **Gee**. First, by agreeing that chrysotile is going to disappear a lot faster than the amphiboles. We so stated.

My answer is twofold. Number one, the epidemiology in man without reference to lung burden is the primary basis of the assertions made.

Senator **Lieberman**. Say that again.

Dr. **Gee**. The epidemiology—that is, the disease in occupational settings in which the fibers in some way or other are known, either by fiber counts in the air or from known exposure in the workplace—that is the primary basis, not autopsy lung burden.

However, it is abundantly clear that there is good evidence that is consistent with what we say. I agree with Dr. Landrigan; "If the Devil has left, he may have done a lot of trouble and we know not that it was him." I share that. My answer is, we have other direct evidence in the epidemiology in the world, and the studies of lung burdens are consistent with that. That's my answer.

Senator **Lieberman**. Let me ask you this, just to try to make it more personal for me, following up on Senator Lautenberg's statement. I've got kids. What would you suggest that I do if I found out that the school in which one of my children is being educated has asbestos? Should I not worry about it at all?

Dr. **Gee**. I am so glad you asked this question because Brook Mossman, who is my coauthor, who has a younger daughter than I do, has been asked this. We are very concerned to say two things. I would want to know the facts before I would make a decision, and among those facts would be the building's state, that is, its construction quality. What precisely is the asbestos that is there and what condition is that in?

My second statement is that as a concerned parent, my concern would be both to be safe and also not to waste money. I would need to know the facts before I could make the decision. Although so many parents are scared of asbestos, and that's frightening, there are lots more who are scared of wasting money and are scared to say so because it is socially very difficult to do it. That's true in New Canaan and it is also true in another city in my State, sir.

Senator LIEBERMAN. Let me just ask you one final question.

What facts would lead you to want to see the school system do something about the problem regardless of the cost?

Dr. GEE. There are two things. If airborne levels would support that there is an unreasonable level, and for that I would have to define certain numbers, then I would be concerned.

Second, I would want to know, to some extent, at least, what the asbestos in question was, which type.

Senator LIEBERMAN. Thank you.

Senator REID. Mr. Lemen, could you briefly tell us what you disagree with?

Mr. LEMEN. I would simply say that Dr. Gee is basing most of his information solely on the epidemiologic literature and discounting the animal pathogenicity and the pathology literature, and he has used Dr. Doll's name as saying that he would agree with this. Unless Dr. Doll has submitted a minority report to the most recent expert panel of the World Health Organization, which Dr. Doll chaired, and which I would be happy to provide to this committee for the record, the panel concluded in relationship to epidemiology and fiber type, that, ". . . it is difficult to substantiate this difference [in pathogenicity] firmly after standardization for exposure level, type of industry, duration of employment, etc." That was an assessment which this expert panel, which I will submit to you, made concerning the epidemiology literature. [The material referred has been received and is retained in committee files.]

So I disagree with his statement based upon that.

Senator REID. We may have additional questions that we will individually submit to each of you. If you would respond to those within the next two weeks, our record will be complete.

Mr. LEE. Mr. Reid, could I also leave with you—since you asked the question about the invitees to the Harvard Symposium, the papers of some 17 authors that were submitted to that symposium, and the summary of that symposium.

Senator REID. We have that, but we could always use another copy. You can't get too many.

Senator LAUTENBERG. Just to clear the air on that, who paid for that conference?

Mr. LEE. It was paid for by an unrestricted grant from four different organizations.

Senator LAUTENBERG. Would you read those names?

Mr. LEE. Sure. The National Association of Realtors, the Institute of Real Estate Manufacture Foundations, the Urban Land Institute, and the Safe Building Alliance.

Senator LAUTENBERG. And of course, the Safe Building Alliance is an organization that deals with asbestos.

Mr. LEE. Yes.

Senator LAUTENBERG. Of course, the realtors—I don't know all of them that you mentioned, but it would be to their advantage, of course, to have less problems with asbestos?

Mr. LEE. In retrospect, I wish I had a few other grants to support that symposium.

Senator LAUTENBERG. Thank you very much.

Senator REID. First, for the next panel of witnesses is Toni Siskin, who is a member of the school board of Broward County; Mr. Joel Packer, Legislative Specialist, National Education Association; Mr. Gregory Veith, Manager of Facilities, Services, and Construction, Catholic Archdiocese of Chicago; and Ms. Dolores Delaney, a member of the Board of Directors of the National Parent Teachers Association.

Ms. Siskin, would you please proceed? When does your plane leave?

Ms. SISKIN. I got an extension until 6:00 o'clock.

Senator REID. Great.

## STATEMENT OF TONI SISKIN, MEMBER OF THE SCHOOL BOARD, BROWARD COUNTY SCHOOLS, ON BEHALF OF THE NATIONAL SCHOOL BOARDS ASSOCIATION

Ms. SISKIN. Thank you very much, Senator. I am Toni Siskin, Chairperson of the Florida School Boards Association, Federal Relations Network, and a member of the Broward County School Board. On behalf of the National School Boards Association I am pleased to have this opportunity to testify before you today on the important issues of the implementation of the asbestos abatement program in schools and the critical need for reauthorization of the Asbestos School Hazard Abatement Act Loan and Grant Program.

Although we believe that each issue discussed in our written testimony is important to the continued success of the Asbestos in Schools Program, because my time is short I would like to focus on the two issues on which all future compliance activities will hinge. Those are, one, a predictable source of adequate Federal funding to assist school district compliance with AHERA, and two, reliable scientific data which supports the expenditure of millions of dollars to eliminate the asbestos health hazard.

When ASHAA was enacted into law, the projected cost of the Asbestos in Schools Program was $3 billion. Since that time we have learned that the cost of compliance for public school districts alone is at least double that amount, and that current cost estimates are constantly subject to increase as a result of unforeseen circumstances or new interim guidance.

As we speak, my daughter is out of her high school because of recently-found asbestos that was disrupted during renovation activity. That school was surveyed very carefully and very accurately by a certified survey company two years prior, but because of the renovations this has occurred. Piper is one of 164 schools slated for renovation in the next two years. In my school district we originally estimated the total cost of our asbestos program to be $24 million. Nevertheless, in the wake of the new rules governing roofing projects, we have been advised that we can expect the actual costs of the program to increase between $10 million and $20 million over projections for the next several years.

Not unlike school districts across the country, the Broward County School District is facing inordinate demands on its limited resources. School board members want to ensure that our students and employees enjoy a safe and hazard-free environment. Unfortunately, we have found increasingly that due to the lack of Federal funding for Federal mandates, school board members are in the unenviable position of being forced to provide that safe environment at the expense of educating our students.

The ASHAA Loan and Grant Program has never received full funding. Millions of dollars have been deposited in the Asbestos Trust Fund but have never been released. It is important for the committee to understand that each dollar that is paid for AHERA compliance is money which could have paid to help Johnny read. And when the Federal Government refuses to bear its share of the cost of compliance with unfunded Federal environmental mandates, it is the students who ultimately pay the price.

Therefore we request that Congress recognize both its unmet and its continuing obligation to the students and the schools that serve them by enacting legislation to, one, reauthorize the ASHAA Loan and Grant Program at $1 billion, less than one-sixth the amount that public schools alone will need to comply with AHERA; two, immediately direct that amounts held in the trust fund account be made available to needy school districts; and three, to provide in future years the trust fund account balance available to needy school districts on an annual basis.

As we have discussed all through this afternoon, I'm sure the committee is very aware that over the past year the news media has published reports which suggest that the type of asbestos commonly found in school buildings does not create a risk to human health. In many instances these reports are attributable to publication of a study undertaken by a group of scientists. Unfortunately, the study and the reports do not mention the fact that several members of the group have served as expert witnesses for defendant asbestos manufacturers in cases arising out of the presence of asbestos in buildings.

In response to these reports, and in the absence of a new study which contradicts the study on which these reports are based, local taxpayers have begun to question the wisdom and the necessity of their school districts spending millions of dollars to comply with AHERA. Therefore, NSBA believes that Congress must assume a leadership role in responding to the confusion and alarm generated by this study by authorizing a grant of $500,000 to fund an objective international study of the asbestos health hazard. To preserve the integrity and reliability of that Congressionally-authorized study, we believe that participation in the study should be limited to persons who have never appeared as expert witnesses for either the plaintiff or the defendant in a case arising out of the presence of asbestos in buildings.

In closing I would commend to the committee for its consideration two additional legislative recommendations.

First, that the committee include in the ASHAA reauthorization two recommendations contained in the report of the Inspector General for Audits on the audit of ASHAA. A copy of those recommendations is attached to our written testimony.

Second, NSBA wishes to commend the EPA Office of Toxic Substances for the invaluable services it has provided to local school districts, and requests that the committee assure that the reauthorization of ASHAA include funding adequate to ensure continued EPA compliance assistance to local districts.

Thank you.

Senator REID. The newspaper article from the Sun-Centennial, dated Thursday, April 19th, 1990, by Berta DelGado, will be made part of the record.

[The newspaper article follows:]

METRO EXTRA

# Asbestos keeps Piper High closed

By BERTA DELGADO
Staff Writer

Broward County school officials may order an asbestos company to re-examine all samples taken more than a year ago in central Broward schools after the discovery of asbestos forced the closing of Piper High School.

Piper remains closed to students today. The school, which is in Sunrise, was off limits to students on Wednesday after workers discovered asbestos in the ceiling of the auditorium while renovating the air-conditioning system. Staff members and teachers will continue working today in the school's 26 portable buildings.

Test results returned late Wednesday showed that levels of asbestos, a cancer-causing substance, exceeded the maximum allowed within the auditorium. No fibers were detected outside the auditorium, but school officials want the rest of the building tested before reopening the building to students, school district spokeswoman Merrie Meyers said.

Meyers said the auditorium was sealed to keep the asbestos from contaminating other parts of the school. Tests will be conducted in the central mall outside the auditorium and the connecting wings and administration offices, Meyers said.

She said the school was originally closed because there was fear the asbestos may have been in the central mall area, where the students' restrooms are.

"That area was closed off, and you can't have school without bathrooms," she said.

Test results for the remainder of the building are expected today. School officials said they expect students to return on Friday.

Like all Broward schools, Piper was examined for asbestos in 1988. Miami-based Testwell Craig Laboratories conducted tests at Piper and 62 other schools in the central part of the county. Two other companies tested the north and south schools.

At the time, the company found asbestos only in the roof of Piper, said Ray de la Feuilliez, associate superintendent for district facilities.

"I'm concerned about their [1988] samples," de la Feuilliez said. "I may insist that they redo every sample in the county. I want to know what went wrong, and if there's a problem, I want to know about it before it happens again."

De la Feuilliez said a representative from Testwell Craig's main office in New York is expected to meet with district officials today. The company will re-examine the 1988 samples from Piper to find out why tests of the auditorium did not detect asbestos fibers, de la Feuilliez said.

Steve Bassett, vice president of Testwell Craig, which specializes in asbestos and construction material testing, said his company called school officials after hearing of the closing.

"We're trying to figure out what went on" in 1988, Bassett said. "We're not waiting around. We're being very active to get to the bottom of this and find out what we can about it."

Senator **Reid**. You are welcome to leave now if you want.

Ms. **Siskin**. I will try to stay as late as I can. There were a lot of things brought up that I have found not to be true in the real world of school boardsmanship that I would love to have the opportunity to comment on.

Senator **Reid**. Mr. Joel Packer.

## STATEMENT OF JOEL PACKER, LEGISLATIVE SPECIALIST, NATIONAL EDUCATION ASSOCIATION

Mr. **Packer**. Thank you. I am Joel Packer, a Legislative Specialist with the two million-member National Education Association. My testimony today will focus primarily on NEA's strong support for S. 1893, the Asbestos School Hazard Abatement Act, as well as NEA's continued support for the Asbestos Hazard Emergency Response Act, AHERA.

First I want to mention that this issue of asbestos in schools is not a new issue. It has been discussed and debated in Congress and EPA for well over 10 years. In fact, NEA itself has testified 20 different times before various Congressional committees and hearings on the various issues of asbestos in schools.

In 1984 we were instrumental in development of the ASHAA program, which authorized $100 million per year to help schools deal with hazardous asbestos. Since that time, 1,571 schools with serious problems and the fewest resources to address them have received over $200 million to assist them with over 2,000 abatement projects. These funds have helped eliminate more than 17 million hours of asbestos exposure per week by students and school employees.

Next month EPA will award about $44 million in fiscal year 1990 funds, which will bring the total to about $245 million, less than 9 percent—8.2 percent—of the $3 billion that EPA itself estimates it will cost schools to comply with AHERA. As you have heard, the National School Boards Association estimates the cost to be over $6 billion.

The scope of the problem is widespread. EPA estimates show that friable asbestos is present in 44,000 school buildings, affecting 15 million children and 1.5 million school employees. Even if we concede some of the arguments by Dr. Gee and Mr. Lee that we should be most concerned only about the custodial workers, several hundred thousand of those people work in those buildings with friable asbestos.

In addition, virtually all of the 107,000 schools contain nonfriable asbestos, which can also release fibers under certain types of conditions.

While I am not a scientist, NEA does want to comment just very briefly about the recent articles downplaying the hazards of asbestos.

First of all, the particular issue of whether chrysotile asbestos is a hazard was reviewed and answered by this committee during a hearing on ASHAA in 1985. The former chairman of the full committee, Senator Stafford, and former Senator Abdnor wrote to several scientists requesting their views on "the health effects of inhaled chrysotile asbestos." So the issue is not new. It hasn't just been raised by Dr. Gee and his colleagues; it was raised five years ago. The committee got several responses, including the following response from Dr. James Mason, who was then Director of the Centers for Disease Control. He concluded that "scientific studies conclusively demonstrate that chrysotile asbestos is a hazardous substance and poses a substantial health risk when inhaled."

Indeed, EPA in 1989—not five years ago, but just last year, when they came out with their rule banning all future manufacture, importation, and distribution of asbestos—stated categorically that "it is well recognized that asbestos is a human carcinogen and is one of the most hazardous substances to which humans are exposed in both occupational and nonoccupational settings."

Dr. William Nicholson from Mount Sinai has estimated that looking at 20 million pupils in schools that may be exposed to asbestos would translate into 800 to 2,400 cases of cancer. We find that unacceptable, particularly when—as Dr. Landrigan had mentioned—EPA regulates other hazards that can cause cancer at the rate of one death per million, and this is a far higher rate.

Again, even if one accepts all the arguments from Dr. Gee and his colleagues, AHERA is not inconsistent with that at all. AHERA does not require schools in most cases to remove asbestos. AHERA stems from the fact that friable asbestos, unless properly maintained and managed, will become damaged and release fibers and create a hazard. Even routine maintenance activities have been found in studies to lead to peak fiber release episodes of 100 to 1,000 times average indoor levels.

In terms of real life problems, two recent studies have found evidence that school custodial workers are suffering—one study in Boston, one in New York City—disproportionately high levels of asbestos-related lung disease.

We strongly believe that the critics of AHERA have misrepresented what it does. It simply requires schools to inspect for asbestos, assess its condition, develop a management plan, and implement a range of appropriate response actions. We strongly would object to and oppose its repeal or significant revision of AHERA.

In terms of ASHAA, just a little bit about the financial need that schools face. Right now in the current round of applications, 862 school districts have applied for over $400 million of funds, and EPA will only be able to give out about $44 million, about 10 or 11 percent of what has been requested. Since the program's inception, fewer than one-third of the projects that EPA itself has ranked as Hazard Category 1—significantly damaged material that is accessible to people in buildings—have been funded. So only one-third of the most hazardous projects have been funded.

I also want to mention that the statute has been supported by a coalition, the Asbestos in Schools Coalition, that represents not only education groups but health groups, labor groups, and other environmental groups.

In closing, one suggestion I want to make for improvement in the reauthorization statute, to follow up on what Ms. Siskin said, is about the Asbestos Trust Fund. The trust fund was created for repaid loans from ASHAA to be deposited into it, and OMB has estimated that by the end of fiscal year 1991 there will be almost $25 million in the trust fund. Not one penny has been released because it can only be released subject to appropriations. We think the statute should be amended to give EPA authority, when the agency itself finds that the requests are qualified and eligible for assistance but exceed the available appropriations, then EPA should be able to go into the trust fund and use those monies. So we hope the committee can look at that, and also explore the financial need criteria that EPA has used.

We look forward to working with you to expand and continue the statute. Thank you.

Senator REID. Mr. Veith, I want to apologize to you on behalf of Senator Simon. He wanted to be here for this part of the hearing, but he just sent me a note that he is tied up in the Budget Committee. There he is trying to get more money for this program, so that's where he should be.

He also sent along his statement with a request that it be entered into the record, and that will be done.

[Senator Simon's statement follows:]

**Statement of**
**Senator Paul Simon (D-IL)**
**before the**
**Subcommittee on Toxic Substances, Environmental Oversight, Research and Development**
**on the**
**ASBESTOS SCHOOL HAZARD ABATEMENT REAUTHORIZATION ACT OF 1989 (S.1893)**

**April 26, 1990**

Mr. Chairman, thank you for the opportunity to sit in on this hearing. Cardinal Bernardin has discussed with me some of the asbestos problems in the Catholic Archdiocese of Chicago, and I am pleased that Gregory Veith is testifying here on behalf of the Archdiocese and the Council for American Private Education.

I am glad to be a consponsor of the reauthorization legislation authored by my colleague from New Jersey [Sen. Lautenberg]. This reauthorization, and other scientific and political developments being discussed today, have brought up a number of issues that I would like to address. My comments can be roughly divided into three issues: safety, funding, and administration.

## Safety Issues

Recent scientific literature has raised questions about the advisability of removing asbestos from buildings. For the most part, these questions were answered years ago when we first passed the Asbestos Hazards Emergency Response Act (AHERA). The law and the Environmental Protection Agency recognize that it is not necessary to remove asbestos that does not pose a health threat to a building's occupants. In most instances the law does not require removal. It is only when the asbestos is in a deteriorated state, is being disturbed by renovation activities, or in other ways presents a hazard that it must be removed.

Unfortunately, those recent reports, along with the misperception that federal law requires the removal of all asbestos in schools, has led some organizations and even some lawmakers to call for the repeal of AHERA. At least three superintendents of school districts of Illinois have called my office asking if they should stop their asbestos abatement activities in anticipation of repeal. One superintendent was prepared to delay a school board vote that night on a $700,000 asbestos management contract. As elected officials, we should not be contributing to a slowdown of progress on addressing the asbestos health threat by fueling rumors of possible repeal. Instead, along with the Environmental Protection Agency, we should be educating schools about what AHERA actually requires, and helping schools with real asbestos abatement problems to address them in a timely manner.

We are just now learning that school custodians in New York City and Boston have an extremely high rate of asbestosis and other lung abnormalities. That is a tragedy. The American Academy of Pediatrics projects 1000 deaths over the next 30 years because of the victims' exposure to asbestos as schoolchildren. That is a tragedy. Let us not allow that number to increase in the future by our failure to act now.

Authorizations and Appropriations

Over the past five years, schools across the country have asked for financial assistance for nearly 4000 asbestos abatement projects classified as Hazard Category I--the most serious rating. Not even a third of these projects have been funded. It is perplexing, therefore, that President Bush has once again zero-funded this program, claiming that the assistance would go towards lower priority hazards.

Despite the administration's consistent refusal to propose funding for asbestos abatement in its annual budgets, Congress has appropriated between $40 and $50 million each year. While that has been an improvement over zero, it has been wholly inadequate in addressing the needs of our private and public schools. That's why this reauthorization is so important. It provides us with a forum for discussing the needs of the schools and applying pressure on Members of Congress and the Administration to better meet those needs. The increased authorization levels in S.1893 will send a strong message to President Bush and the appropriating committees of the need to abate asbestos hazards in schools before we regret our inaction.

Furthermore, as a member of the Budget Committee, I am proposing that we more than triple the funding for asbestos abatement in the 1991 budget. My proposal is that we take three percent of the defense budget and put half of the savings towards deficit reduction. Of the remainder, half would go to education, and the other half to health care. In my proposal for the education funds, I am including a $150 million appropriation for the asbestos abatement program.

## Administration

Finally, I would like to comment on the EPA's administration of ASHAA. I should point out that my concerns about how the EPA cuts up the ASHAA pie might not exist if the EPA had a whole pie to cut up in the first place. That's why the funding issue I have mentioned is so crucial. Given the likelihood of continued inadequate funding, however, these administrative issues must be addressed.

I should also stress that the EPA has been very straightforward about how it operates the ASHAA program. From the viewpoint of the applicants, grant making often seems to take place in a black box -- applicants don't quite know why they did or did not receive funding. In contrast, the EPA has endeavored to help schools determine whether they should even apply for assistance in the first place, saving them the time and trouble of pursuing a hopeless cause. It is, in part, this openness about its policies that has led some school districts to feel the victims of systematic exclusion rather than the more common mysterious exclusion.

Having opened that black box, however, ASHAA administrators must now either defend its contents or propose changes in the program, and I would like to encourage the latter.

In enacting ASHAA, Congress wisely directed funds to school districts without the financial resources to address their asbestos problem on their own. The statute suggests a number of factors that might be taken into consideration in determining a school district's financial need. They include:

- o The estimated per capita income of people living in the area covered by the school district (LEA).
- o The cost of asbestos abatement compared to the total budget of the LEA.
- o The borrowing capacity of the LEA.

On the application forms for ASHAA funding, the EPA asks for the following additional information, some of which could be used in determining financial need:

- o The enrollment of the LEA.
- o The number of disadvantaged (Chapter 1) students in the LEA.
- o The population of the area covered by the LEA.
- o Special circumstances (optional).

Once a school district meets the initial qualifications for funding, it is my understanding that the EPA uses a variety of these criteria, along with the hazard priority, to determine whether a project is funded, how much it is funded, and how much is provided in loans versus grants.

Mr. Chairman, I have no argument with that process, and I support the provision in S.1893 that includes the costs of serving disadvantaged students as a financial need factor in the statute (though we should ensure that the definition of "disadvantaged" includes students with disabilities).

It is in the determination of which LEAs are initially eligible for funding that concerns me. I notice that this was mentioned in the written testimony of at least two of the witnesses appearing before the subcommittee today, and the EPA is professing to be reviewing the process in some of its written materials. I am pleased that the issue is getting some attention.

The problem is that to make the first cut, the EPA uses ONLY the per-capita income criterion to determine which public school districts have enough financial resources to manage their asbestos problem without federal help. The EPA automatically eliminates any application from a public school district with average per-capita income in the top 30% of the country. For private schools, the EPA uses per-pupil spending to eliminate the top 30% of the applicant pool. Those applications are summarily rejected without any consideration of the other financial need factors.

While the per-capita and per-pupil cutoffs are a convenient way of limiting the number of applications that must receive in-depth analyses by EPA staff, I am not convinced that the cutoff is equitable.

"Need" cannot be meaningfully evaluated without considering the cost of a project and the number of people available to share the burden. For example, if Private Schools A and B have per pupil budgets of $1,500 and $1,700, respectively, under EPA's cutoff in 1986 an ASHAA application from A would be considered, while B would be automatically rejected. If the schools and their asbestos problems were similar in all other ways, this may be a necessary and appropriate line to draw; however, if they have the same number of students but School B has a multi-million dollar asbestos abatement problem while School A's problem is minor in cost, it's quite likely that B is more "needy."

If A and B in the above example were public school districts with average per capita incomes of $9,000 and $10,000, respectively, the scenario would be the same.

Joel Packer of the National Education Association has brought up another problem with the strict per-capita and per-pupil cutoffs: in comparing the wealth of different regions of the country, these measures fail to take varying cost-of-living into consideration. In my own state of Illinois, a $9,915 per-capita income cutoff may make sense in Springfield, where the cost of living is near the national average. In parts of the Chicago area, however, where the cost of living can exceed the national average by close to 25 percent, a cutoff of about $12,300 may be more equitable.

Some type of cutoff may be reasonable, and can help identify school districts that would clearly not be eligible for funding. Some consideration must be made, however, for those cases in which the crude cutoff may be inappropriate. By bringing up the issue of spending on the needs of disadvantaged students, S.1893 already concedes that there are factors to consider other than per capita income or per pupil spending.

Mr. Chairman, the current statute certainly anticipated that the cost of asbestos abatement would be included in the determination of financial need, and I would suggest amending the bill or inserting report language so that the EPA does not reject an application without considering the abatement cost and the "special needs" costs identified in section 5(c) of the bill. This would not be a great burden to the agency: for abatement costs, the EPA could simply establish a cost cutoff in addition to the per pupil and per capita cutoffs. For example, including a cost cutoff of $500,000 would require a more detailed review of only about five percent of all projects submitted this year. Consideration of cost-of-living and other issues would be more difficult, but possible solutions should be explored.

Again, thank you for the opportunity to sit in with the subcommittee today. I look forward to working with you on this issue.

## STATEMENT OF GREGORY VEITH, MANAGER OF FACILITIES, SERVICES, AND CONSTRUCTION, CATHOLIC ARCHDIOCESE OF CHICAGO, ON BEHALF OF THE COUNCIL FOR AMERICAN PRIVATE EDUCATION

Mr. VEITH. Mr. Chairman, I would like to take this opportunity to thank you for allowing me to testify at this hearing today. My name is Greg Veith, and I am Manager of Facilities and Construction for the Catholic Archdiocese of Chicago. I am representing the Council for American Private Education.

As the designated person for our school system, I am responsible for the asbestos program for the seventh largest school system in the country, with 393 schools. This responsibility includes implementation of the AHERA laws, inspections, management plans, project design, worker training, and ensuring that the response actions shown in the management plan are properly carried out.

The Council for American Private Education is a Washington-based coalition of 14 national organizations, representing private elementary and secondary schools. We include Catholic, Lutheran, Montessori, Hebrew Day, Independent, Quaker, Seventh Day Adventist, Christian Schools International, military schools, Solomon Schechter, Episcopal, and private schools for exceptional children. In this country, 12 percent of elementary and secondary students attend private schools; 13 percent of our teachers teach in private schools, and 25 percent of all schools are private. There are some 27,000 private schools in all, serving 5,241,000 students. These statistics were taken from the National Center for Education Statistics.

CAPE strongly urges passage of S. 1893, reauthorizing ASHAA, as this is the only source of Federal funds available to schools to assist us in implementing the AHERA program. AHERA-mandated response actions, as everyone knows, are very costly. Since July, 1989, when schools were required to begin the response actions, estimated costs have escalated and are expected to continue to do so. For example, we believe that the EPA cost estimate of $3 billion is far short of the actual cost.

The U.S. Catholic Conference, also a member of CAPE, conducted a survey this year on projected costs for abatement, including the cost of initial inspection and management plans. With 105 of 176 dioceses responding, the actual costs total $430 million. This represents only 60 percent of the dioceses. Therefore, this figure could easily grow to $1 billion.

The Archdiocese of Chicago spent $1.5 million for initial inspections and management plans. Additionally, since May of 1989, we spent another $5 million for training, implementation of the O&M programs, equipment, and necessary removal and disposal of asbestos.

If we were to remove and replace all of the asbestos in our schools, the cost would be over $200 million. However, we have chosen one of the other four response actions to implement the AHERA regulation, reducing our cost projection to $15 million over the next three years.

CAPE conducted a survey of its non-Catholic schools and found the following:

Ninety-three Illinois Lutheran Church-Missouri Synod schools will spend about $3.7 million.

The 20 Christian Schools International of Illinois and Indiana will spend over $1 million.

The 25 mid-Atlantic Seventh Day Adventist schools will spend about $2.2 million.

Private schools in New York State alone will spend well over $100 million.

Private schools cannot pay for these projects by raising taxes, but are forced to either raise tuition or find other innovative fundraisers. In reality, programs are either curtailed or cut back. The cost of asbestos is a factor in the closing of private schools, including the 12 schools we are going to be forced to close this June in Chicago.

CAPE certainly supports ASHAA reauthorization. However, we would like to see the deadline for application approval be changed to January from May in order for the LEAs to properly plan for summer work. Also, provision should be made for the LEAs to distribute and/or redistribute funds at the local levels. For example, the triennial inspection will be due in 1992. S. 1893 allows for funding of these inspections, but the paper process wouldn't make it feasible.

Although the Administration did not include funds for asbestos abatement in its 1991 budget, EPA has been very helpful in working with the schools on both ASHAA and AHERA. We thank the Environmental Assistance Division for convening a meeting on rethinking the financial needs analysis for private schools, and for the continued communication on that and other topics. We hope that we can continue to work to come up with an even more equitable formula for determining financial need, one that might even draw from other Federal programs.

We also think there may be place for inclusion of a hardship factor imposed on schools by extraordinarily costly projects.

Both the public and private schools have had to cut back on their education programs in order to pay for these costs. At a time when schools are working very hard to equip children with the many skills that are needed for their success. We urge Congress to make a large commitment to help shoulder the cost of protecting our safety.

It is now that the schools need Congress' support for reauthorizing ASHAA at the highest possible figure, but not less than $250 million annually over the next five years.

Again, I thank you for this opportunity to testify.

Senator REID. Ms. Delaney.

## STATEMENT OF DOLORES DELANEY, MEMBER, BOARD OF DIRECTORS, NATIONAL PARENT TEACHERS ASSOCIATION

Ms. DELANEY. Senator Reid, thank you very much for this opportunity to give testimony from the national PTA, representing over 6.6 million parents, teachers, students, and other child advocates. I would ask that our complete testimony be included as part of the record.

Senator **Reid**. Yes. I would ask you to summarize it in five minutes, if you would, please.

Ms. **Delaney**. I will.

I currently serve as a member of the Health and Welfare Commission of the National PTA Board. The National PTA strongly supports S. 1893, legislation to reauthorize ASHAA. This issue has personal significance to me because during my tenure as Virginia PTA President I was involved in the asbestos crisis in my own State that continues today.

In York County, Virginia, two elementary schools were closed down for at least this current academic year when significant asbestos contamination was discovered. Over 1,200 children were displaced and thousands of dollars worth of textbooks and supplies had to be destroyed.

To simply recount the events of the York County situation does not convey the unseen emotional toll that the parents, teachers, and students at these schools have experienced. In addition, the county will be hard-pressed to find the $500,000 they will need to abate the asbestos hazard in their schools.

I am certainly not a scientist. I am a parent and advocate for children. I do know that there are many schools with significant asbestos hazards and that insufficient Federal funding is available to help them. I also know that we must support Federal legislation now in place, specifically, ASHAA and the Asbestos Hazard Emergency Response Act, or AHERA, if we hope to eliminate this unnecessary risk.

I might add parenthetically that without AHERA, it might be difficult for Dr. Gee to ascertain whether or not there was a safe level in his child's school if there was no inspection.

Many of the witnesses who preceded me have presented much of the information contained in our testimony. Therefore, I will highlight some of our key points.

The National PTA remains strongly convinced that, one, there is no known level at which exposure to asbestos is considered safe; two, 15 million children and 1.5 million school employees are exposed to friable asbestos-containing materials at more than 44,000 schools nationwide; three, children, because of their longer remaining lifespans and higher rates of breathing, are more susceptible to the dangers posed by exposure to asbestos than are adults.

Knowing this, the National PTA cannot sit back and wait while the experts prolong the debate about whether asbestos is hazardous or not. Those who attempt to minimize the risk to the general population offer that asbestos is only harmful to workers who are exposed in occupational settings to high levels of asbestos over long periods of time. However, in a recent study of public school custodians in Boston, Dr. Christine Oliver of Harvard Medical School found an unusually high rate of lung scarring among those workers whose only exposure to asbestos was during their long tenures in the schools.

At Mount Sinai School of Medicine, a recent examination of school custodial workers yielded similar results. In addition, the EPA recently reported that it is well recognized that asbestos is a human carcinogen and is one of the most hazardous substances to which humans are exposed in occupational and nonoccupational settings. Further, the EPA states, "these conclusions regarding the health effects of asbestos exposure represent a widely-accepted consensus of opinion of health agencies, scientific organizations, and independent experts.

Knowing this, why would any of us allow our children to remain in classrooms or school buildings that have friable asbestos-containing material while the experts conclusively decide at what level the exposure becomes hazardous?

The National PTA is not willing to stand back and wait as school children test the level of risk of asbestos in their classrooms.

Increased Federal funding for ASHAA is critical to assure that school districts are not forced to postpone the purchase of needed educational supplies or materials in order to fund needed asbestos abatement projects. The National PTA is extremely concerned about this issue and remains convinced that asbestos in schools is a national crisis warranting increased Federal involvement.

We vigorously oppose repeal of AHERA and strongly urge Congress to reauthorize ASHAA and provide significant funding increases for the Loan and Grant Program.

In conclusion, for the sake of this testimony let us accept for a moment the contention that low-level exposure to asbestos does not pose a risk to children and employees in schools. This reasoning would not contradict support for either AHERA or ASHAA. In fact, accepting this argument strengthens the need for both measures. It seems you would at least want to ensure that asbestos exposure remains at low levels. In order to do this, we would have to hire qualified personnel to test if we had high levels of asbestos, reduce high levels if found, periodically inspect for changes in the condition of non-damaged asbestos-containing materials, and abate asbestos that has been damaged. In other words, we would follow provisions similar to those outlined in AHERA.

Similarly, we would not oppose ASHAA because ASHAA simply provides funding to school districts for abatement of asbestos hazards that have already been determined to be very dangerous.

Thank you for this opportunity to comment on S. 1893. We would be happy to respond to questions.

Senator REID. Mr. Packer, do you know what percentage of schools have what is considered a serious asbestos problem?

Mr. PACKER. EPA itself estimates 44,600 schools have friable asbestos.

Senator REID. How many?

Mr. PACKER. Some 44,600, which is over 40 percent of all schools in the country.

Senator REID. Those schools that have adopted plans, to your knowledge have most of them gone with removal as compared to abatement?

Mr. PACKER. I'm not aware that anybody has any hard data about what schools have actually done. All schools had to have started implementing their management plans as of July 9th, but we don't have data about what exactly they are doing.

One point I want to make about the management plans—and Ms. Fisher of EPA said this, too—as of July 9th, 1989, there are few deadlines in the statute imposed on schools. The school in it's plan, selects its own response actions, and sets its own schedule, and the school can change either of those based on financial problems, new scientific evidence, etc. Schools may also decide to remove as opposed to encapsulating for economic reasons. As was mentioned earlier, it may be less expensive in the long run to remove it and be done with it than perhaps have to keep in place the various special maintenance activities to prevent undamaged material from becoming damaged.

So I think one of the studies that EPA is doing is going to come up with that data, but I don't know if school boards have it.

Senator **Reid**. Mr. Veith, in your testimony you emphasize the need to get the loan and grant applications within a specified period of time—I think you said 45 days after the appropriations have been made. Why?

Mr. **Veith**. I think in the oral testimony today I recommended that the school boards or the LEAs know how much money they're going to have by January, because most of the work for schools is done during the summertime. This gives you enough time to get proper design, proper planning, and proper bidding done. As it is, the money comes out in May right now. That gives us about 30 to 35 days to get all of this work done.

Ms. **Siskin**. Senator Reid.

Senator **Reid**. Yes, please.

Ms. **Siskin**. I know that NSBA does not have specific percentages of how many school systems encapsulized and how many removed, but I do know that in the real world of dealing with school boards and with parents and when I speak with my colleagues across the country, it is not true that the superintendents and the school boards did not realize all the options. I think all of their options were made very clear, and I don't believe they're running quickly to total removal because no one likes to unnecessarily disrupt the lives of students and parents. In that regard, school board members are not seeking to close schools in exorbitant numbers to remove asbestos if they do not believe that it is absolutely essential to comply with AHERA.

Senator **Reid**. Would you answer the question that I have asked several witnesses and talked about here a lot? Being a member of a school board, how do you explain to the parents, if the school has asbestos in it?

Ms. **Siskin**. My experience in Broward County is that parents are quite rational and reasonable when it comes to this. If it is explained very carefully that—for instance, this is in an area that does not have student traffic, that building occupants do not come into contact with as bestos, there are no exposure hours and, that it would be easier and faster to encapsulate with no disruption to students and teachers—they understand it perfectly well.

In large measure, the problem that we're experiencing is the result of renovations that we have both for growth needs in our county and for meeting the curriculum needs of making our schools able to teach our students for the 21st century, including computer labs, science labs, high tech labs——

Senator **Reid**. And this asbestos removal money is coming from those programs?

Ms. **Siskin**. It's coming from our capital program. We have to budget for AHERA through our capital program. When we have to float bonds to get enough dollars to build and renovate our schools, we have to factor in the dollars we're going to need and the money we have to ask for.

Senator **Reid**. And you get little help from Washington?

Ms. **Siskin**. Broward County is one of those areas they deem too rich to be helped.

Senator **Reid**. Just like Wyoming.

What guidance do the schools receive from EPA when devising their management plans for this asbestos?

Ms. **Siskin**. Our facilities managers have gotten wonderful guidance and information on how to go about it.

Senator **Reid**. From EPA?

Ms. **Siskin**. I'm not sure—toxic substances—that entity is the one they deal with most closely.

Senator **Reid**. I see someone shaking their heads.

Ms. **Siskin**. Yes, but the information to the districts has been wonderful.

Mr. **Packer**. If I can add something, the National PTA and NEA jointly cooperated with EPA on a publication called "The ABCs of Asbestos in Schools." I don't have one here with me but I would be happy to submit it for the record. We have distributed it to our local affiliates. I believe the PTA distributed it, and EPA sent it to every school district.

The exact purpose of that publication is that it was designed so that the average parent and the average teacher would have an understanding of what the law requires.

Just one quote from that, the publication says that AHERA "rarely requires removal of asbestos," and talks about how, if the asbestos is in good condition, in-place management is usually preferable.

So EPA has cooperated with our organizations on trying to communicate, not only to the schools, but to parents and teachers about these types of risks.

Senator **Reid**. How well does the EPA inform schools about the dangers posed by asbestos? Anyone can respond to that.

Ms. **Delaney**. Senator Reid, perhaps I could explain by saying that EPA does it through those who are the primary communicators at the schools. I think most of us would say it is through teachers, through school boards, and through parents, through publications, and through programs.

To cite an example, at the schools that I mentioned in my testimony, at Grafton Bethel School the children went to school on Tuesday. On Wednesday, it was determined that there was a fine film covering everything in the school, including the cafeteria and where the children were eating, and on Thursday the children's buses were turned back and sent home.

Now, one would think that would create a major catastrophe when we are talking about elementary school children, but because we were able to organize the parents very quickly and bring the information to them, we avoided panic. And while it was very uncomfortable for elementary school parents to have their children separated into three different schools for the remainder of the year—it broke up their communities and everything—EPA provided very valuable information, and we broke it down into a form that all parents could understand. It has worked well.

Senator **Reid**. That's good.

Tell me, you two—the parent-teacher organization and the school board—do you find that local taxpayers are willing to pay extra money for this asbestos problem?

Ms. **Siskin**. We were lucky in that we were able to float a bond for capital improvement, and it was mentioned that part of those dollars included the projected need for asbestos abatement. We floated our bond before these new studies came out by these expert witnesses saying, "Never mind."

Senator **Reid**. Tell me what would happen if ASHAA were not reauthorized.

Mr. **Packer**. It would be very simple. There would no longer be any Federal money available to help schools deal with these problems.

Senator **Reid**. Even though the amount that we have provided is limited, it has still been a big help?

Mr. **Packer**. Absolutely. As I mentioned in my testimony, it has resulted in a reduction of 17 million hours per week of asbestos exposure. It has given awards to several thousand projects, 1,500 schools, and certainly the larger the amount of money that we can provide, the more schools that can be assisted with that.

Senator **Reid**. You have done an outstanding job. We appreciate your patience, but I'm sure you didn't mind listening to the other witnesses anyway. I'm sure you all learned, as we did.

We look forward to trying to come up with guidance for the Congress and the Administration, and that's the purpose of this hearing. Thank you very much for your testimony.

The committee stands adjourned.

[Whereupon, at 4:46 p.m., the subcommittee was adjourned, to reconvene at the call of the Chair.]

[Statements and other material submitted for the record and the bill S. 1893 follows:]

**STATEMENT OF**
**LINDA J. FISHER**
**ASSISTANT ADMINISTRATOR**
**FOR PESTICIDES AND TOXIC SUBSTANCES**
**U.S. ENVIRONMENTAL PROTECTION AGENCY**
**BEFORE THE**
**SUBCOMMITTEE ON TOXIC SUBSTANCES,**
**ENVIRONMENTAL OVERSIGHT,**
**RESEARCH AND DEVELOPMENT**
**OF THE**
**COMMITTEE ON**
**ENVIRONMENT AND PUBLIC WORKS**
**U.S. SENATE**

**APRIL 26, 1990**

Mr. Chairman and distinguished members of this Subcommittee, I am Linda Fisher, Assistant Administrator for the Office of Pesticides and Toxic Substances (OPTS) of the U.S. Environmental Protection Agency. I very much welcome the opportunity to clarify the Agency's policies to reduce asbestos exposure in the Nation's schools. I would also like to set the record straight with regard to a number of recent studies and reports which have received a lot of media attention.

Allow me to first address some of the specific concerns you have regarding the EPA asbestos in schools program.

## Implementation of AHERA

As you know, on October 22, 1986, President Reagan signed the Asbestos Hazard Emergency Response Act (AHERA), under which the EPA is directed to issue regulations that require public and private elementary and secondary schools to inspect their buildings for asbestos, develop asbestos management plans and submit them to their state, and to implement appropriate response actions such as in-place management, repair, encapsulation or removal. AHERA also required schools to use accredited personnel to carry out these inspection management activities.

AHERA established very ambitious deadlines for EPA and the schools to implement this program. EPA was required to issue by April, 1987 a Model Accreditation Plan for training and accrediting inspectors, planners, and abatement contractors and workers. EPA was also required to promulgate final regulations for asbestos inspection and management by October, 1987. The Agency met both these deadlines. The nation's schools also faced a difficult deadline of October, 1988 for completing inspections and submitting management plans to states. Congress later amended AHERA to give schools the option of extending this deadline to May, 1989. EPA's analysis indicates that at least 94% of the nation's schools now have completed their inspections and management plans. Thus, after more than three years of hard work by EPA, states, and the schools, a framework for managing asbestos risks in schools is now in place.

## Accreditation of Asbestos Personnel

As mentioned above, EPA was directed to issue under AHERA a model accreditation plan to provide training and accreditation for persons who inspect, manage and abate asbestos in schools. The training and accrediting of sufficient numbers of inspectors and planners to meet the demands being placed on school districts by the AHERA requirements posed a major challenge for us. The competence of these accredited persons, and the quality of the work they perform in our schools is an ongoing concern for EPA. EPA has substantially increased the number of competent asbestos professionals. In fact, we believe that EPA's university training centers, and a couple of leading labor training programs alone have accredited nearly 60,000 individuals. In all, we estimate 100,000 or more AHERA-accredited persons are available nationally for asbestos-related work today.

The model plan specified criteria necessary for initial training, examination and continuing education required under AHERA for accreditation of persons in all asbestos management disciplines, including inspectors, management planners, abatement supervisors and abatement workers. These persons can be accredited by states, which are required under AHERA to adopt contractor accreditation plans at least as stringent as the EPA model plan by July, 1989 or by completing an EPA-approved training course and passing an examination.

We developed a system to insure the fast, efficient, and competent review of proposed accreditation courses submitted to EPA by private training organizations. As of February, 1990, a total of 587 training providers are offering 1,113 EPA-approved training courses for accreditation, including 487 asbestos worker courses, and 373 courses for contractors and supervisors. EPA has promoted national consistency by publishing model course curricula for AHERA contractor, inspector and management planner training, while model materials for abatement workers and custodial workers will be available this summer.

EPA has financed and implemented several projects in addition to the Model Plan that were designed to develop and enhance State accreditation programs:

- EPA through the National Conference of State Legislatures (NCSL), provided the States with model legislation to assist them in developing contractor certification programs and fee-based funding options to support these programs;
- Since 1985, EPA has awarded $2.5 million in grants to 39 States for the purpose of establishing abatement contractor and worker certification programs since 1985;
- In 1987, the Agency approved grants totalling more than $1 million for 17 States to help them develop AHERA inspector and management planner accreditation programs;
- In 1990, EPA has recently distributed an additional $1.5 million for State activities, which included accreditation programs as part of our effort to enhance State asbestos programs.

Today, due in part to EPA seed funding and technical assistance, 20 States now have accreditation programs that meet AHERA standards for abatement contractors and workers who conduct school projects. In addition, another 27 States have some type of licensing or certification program for asbestos abatement which can upgrade to AHERA levels. Of these 47 States, 42 have extended their asbestos training and certification requirements to cover abatement work in public and commercial buildings as well as schools. This is a dramatic improvement from 1985, when only four States had any kind of contractor certification program at all. Now only three states have no certification program at all.

Several other training and accreditation efforts should be noted. First, EPA has provided funding to the National Asbestos Council (NAC), the nation's largest interdisciplinary asbestos professional organization, to develop standard national examinations for AHERA accreditation disciplines and promote reciprocity among states. In addition, in 1989 and 1990, EPA will provide a total of $1.9 million to joint labor-management trust funds to increase asbestos worker training. Also, the Asbestos National Emission Standard for Hazardous Air Pollutants (NESHAP), which requires asbestos removal to protect public health during major building renovations and demolitions, is being revised this summer to include new training for the on-site work supervisor. Finally, EPA, under the Toxic Substances Control Act (TSCA), extends the protections afforded by the U.S. Occupational Safety and Health Administration (OSHA) to private sector asbestos workers to state and local government employees.

## Evaluation of AHERA

As the AHERA program has progressed, EPA has begun to evaluate the effectiveness of the inspection and management regulations and the accreditation programs we have established. A major evaluation of the AHERA program is underway, and we should begin to receive results from some portion of the evaluation in the next 6-12 months.

Five studies will comprise the AHERA evaluation. The first study will include site visits and reinspection. The objective of this study is to ascertain whether or not inspections mandated by AHERA are being done properly and whether material is properly assessed.

The second study will measure the quality of the management plans in providing useful, accurate, and detailed information. Management plans will be compared to the original AHERA inspection reports. An analysis of the options in the plans for managing the asbestos will be done to see if they are specific enough to provide real guidance to the Local Education Agencies (LEAs). Between 200 to 400 schools will be completely reinspected and their management plans will be reviewed for accuracy and completeness.

The third study includes site visits to determine whether maintenance and custodial personnel have received training, and also examines the operation and maintenance plan and determines whether it is being implemented.

The fourth study deals with the effectiveness of notification for AHERA requirements. This study seeks to identify the people who were notified, the medium through which the notification was accomplished, and the response of the people who were notified.

The fifth study is a series of on-site visits designed to evaluate response actions. This study seeks to determine what response actions have been or are being done and whether or not they are completed in a professional manner.

## Asbestos Loan and Grant Program

I would like now to discuss the school loan and grant program established under the Asbestos School Hazard Abatement Act (ASHAA) of 1984.

As you know, ASHAA established a program within EPA to provide financial assistance to public and nonprofit private schools to help them conduct asbestos abatement projects. Under the provisions of ASHAA, EPA is to provide financial assistance to LEAs which have both serious asbestos hazards and a demonstrated financial need.

Since its inception in 1985, EPA has distributed a total of $201.8 million in ASHAA funds, for 2,194 abatement projects. Public schools have been awarded $178 million. Private schools have received $23.8 million. As a result of the abatement projects conducted using ASHAA funding, exposure of students and school employees to asbestos will be reduced by an estimated 17.3 million hours each week.

Regarding the 1990 award cycle, approximately $43 million will be distributed to LEAs. Applications were made available through a toll-free number provided in the announcement memo mailed to school districts and private schools nationwide. EPA is now reviewing the 862 applications submitted by public school districts and private schools from 46 States. Those applications contain 3,346 separate abatement projects, in 1,856 schools. Our review of these projects includes approximately 100 field inspections by EPA Regional personnel to verify project descriptions and hazard data. The awards will be announced in May, 1990.

When the 1990 awards are distributed in May, a total of $245 million in federal funding will have been provided for asbestos abatement in local schools over the past five years. This investment of federal funds has addressed a significant portion of the most severe asbestos hazards in the most needy schools. While we do not oppose reauthorization at this time, we are concerned that this may not be the best use of scarce resources for a problem which is essentially a State and local responsibility.

Risk, Exposure, and Abatement Issues

Now that I have discussed issues relating to EPA's administration of AHERA and ASHAA, let me turn to another topic.

Regrettably, EPA's asbestos policies have recently been the subject of several erroneous news reports and at least two seemingly contradictory exposure studies which have confused, rather than enlightened, the public.

For example, a national television news report on asbestos in floor tile last November suggested that dangerous fiber levels were generated through routine floor stripping operations to remove wax from tile. This news report promoted a "one fiber can kill" image in the public's mind of an asbestos material that rarely if ever releases fibers under normal conditions. On the other hand, an article on asbestos published on January 19 in Science magazine, followed by various editorials, has been interpreted to suggest that the most common form of asbestos fibers in buildings are "safe" and do not warrant our attention or concern.

Frankly, I appreciate this chance to clarify the Agency's current policies and requirements for asbestos control in schools and public and commercial buildings.

**FACT ONE: Although asbestos is hazardous, human risk of asbestos disease depends upon exposure.**

Asbestos is known to cause cancer and other disease if fibers are inhaled into the lung and remain there. This conclusion is based upon studies involving human exposure, particularly exposure at high levels. While evidence is better for some types of asbestos, there is no clear proof that other types are not as potent. EPA, based on careful evaluation of available scientific evidence, has adopted a prudent approach in its regulations of assuming that all fibers are equally potent. While, as the Science article indicated, exposure to chrysotile or common white asbestos may be less likely to cause some asbestos-related diseases, various scientific organizations, including the National Academy of Sciences, support EPA's more prudent regulatory approach.

With respect to the so-called "one fiber can kill" image, the present scientific evidence will not allow us to state unequivocally that there is a level of exposure below which there is a zero risk, but the risk in fact could be negligible or even zero.

However, the mere presence of a hazardous substance, such as asbestos on an auditorium ceiling, no more implies disease than a potential poison in a medicine cabinet or under a kitchen sink implies poisoning. Asbestos fibers must be released from the material in which they are contained, and an individual must breathe those fibers in order to incur any chance of disease.

While scientists have been unable to agree on a level of asbestos exposure at which we, as public policy makers, can confidently say, "there is no risk," this does not mean that all or any exposure is inherently dangerous. To the contrary, almost every day we are exposed to some prevailing level of asbestos fibers in buildings or experience some ambient level in the outdoor air. And, based upon available data, very few among us, given existing controls, have contracted or will ever contract an asbestos-related disease at these low prevailing levels.

**FACT TWO:** **Prevailing asbestos levels in buildings --** the levels that you and I face as office workers or occupants -- **seem to be very low,** based upon available data. **Accordingly, the health risk to building occupants --** you and me -- **also appears to be very low.**

Indeed, a 1987 EPA study found that air levels in a segment of Federal buildings with management programs were so low as to be virtually indistinguishable from levels outside these buildings. While these data are not conclusive and we are seeking more information through a major research effort, the present evidence suggests that building occupants face only a very slight risk. Severe health problems attributed to asbestos exposure have generally been experienced by workers in industries such as shipbuilding, where they were constantly exposed to very high fiber levels in the air, often without any of the worker protection now afforded to them under the law.

**FACT THREE:** **Removal is often not a building owner's best course of action to reduce asbestos exposure.** In fact, an improper removal can create a dangerous situation where none previously existed. It is important for everyone to understand that AHERA regulations do not require removal of asbestos.

Asbestos removal practices by their very design disturb the material and significantly elevate air levels, which must be carefully contained during the removal project. Unless all safeguards are properly applied and strictly adhered to, exposure in the building can rise, perhaps to levels where we know disease can occur. Consequently, an ill-conceived or poorly conducted removal project can actually increase rather than eliminate risk.

**FACT FOUR:** **EPA only requires asbestos removal in order to prevent significant public exposure to asbestos during building renovation or demolition.**

Prior to a major renovation or demolition, asbestos material that is likely to be disturbed or damaged to the extent that significant amounts of asbestos would be released, must be removed using approved practices under EPA's asbestos NESHAP. Demolishing a building filled with asbestos, for example, would likely result in significantly increased exposure and could create an imminent hazard. Clearly, asbestos removal before the wrecking ball swings into action is appropriate to protect public health. However, this cannot be said of arbitrary asbestos removal projects, which, as noted above, can actually increase health risk unless properly performed. This, in part, is why EPA has not mandated asbestos removal from buildings beyond the NESHAP requirement, which has the effect of gradually and rationally taking all remaining asbestos building materials out of the inventory.

**FACT FIVE: EPA does recommend in-place management whenever asbestos is discovered.**

Instead of removal, a **proactive in-place management program**, which includes training, awareness, special control procedures and periodic surveillance, will usually control fiber release, particularly when the materials are not significantly damaged and not likely to be disturbed. In-place management, of course, does not mean "do nothing." When a building owner finds asbestos in his facility and ignores it, he can't establish and enforce procedures to ensure that the asbestos is not disturbed. He can't ensure that fiber levels do not rise. An in-place management program does not have to be extraordinarily expensive. Management costs will depend upon the amount, condition and location of the material.

As I'm sure you're aware, maintenance and service workers in these buildings, in the course of their daily activities, may disturb materials and can elevate asbestos fiber levels, especially for themselves, if they are not properly trained and protected. For these persons, risk may be significantly higher. This is a primary concern of EPA and other Federal, State and local agencies which regulate asbestos. An active in-place management program will reduce any unnecessary exposure to these workers and others.

To summarize the facts, as we now know them:

- o While asbestos is clearly hazardous, its risk to human health depends on the degree of exposure.
- o Asbestos air levels in buildings, and corresponding risk to occupants, appears to be very low, given available data.
- o Asbestos removal, while necessary to protect public health during renovation or demolition, is not otherwise required by EPA and is often not the building owner's best abatement choice.
- o EPA's asbestos program for schools and its guidance for other building owners, which is founded on in-place management, is designed to keep these low prevalent fiber levels low, through recognition and management.

We agree with Dr. Arthur Upton, former director of the National Cancer Institute and head of New York University's Institute of Environmental Medicine, who, in a letter to The New England Journal of Medicine, advocates caution in dealing with asbestos until better information is available. Dr. Upton maintains that "abandonment of asbestos inspection and abatement is not justified" by the current data.

Further, we are presently attempting to increase the knowledge base on asbestos on several fronts, which include a public dialogue, and a major research program.

**Through the public dialogue process** . . . EPA has sponsored a policy dialogue among groups which have a major interest in the asbestos policy regarding public and commercial buildings. These groups include building owners, realtors, mortgage bankers, insurers, building workers unions, public health interests, asbestos contractors and consultants, asbestos manufacturers, and representatives of federal, state and local organizations which have responsibility for the development and implementation of asbestos policies.

The policy dialogue is now in its final stages, and EPA expects the dialogue participants to present the Agency with a set of general recommendations about what they think should be done to address the issue of asbestos in public and commercial buildings. The dialogue participants have discussed at length accreditation, training, and improper removal issues. EPA has made a public commitment to consider thoroughly any recommendations offered by the dialogue participants and to decide, as soon as possible, whether to carry out any or all of the recommendations.

**Through the Health Effects Institute Research** . . . Finally, asbestos research initiated by the Health Effects Institute (HEI) in Boston with EPA, Congressional and private sector support will include comprehensive monitoring studies to better characterize asbestos exposure in buildings. HEI's initial literature review will also examine current research which deals with fiber potency.

At EPA, we are particularly concerned about potential "peak exposures" -- those which might occur in buildings when material is disturbed or accidentally damaged. Such disturbance can elevate levels not only for workers, but perhaps also for building occupants who might ordinarily _not_ experience high levels. "Peak" levels have been known to reach the range of occupational exposure for maintenance and service personnel. HEI's research should be very helpful in increasing our knowledge on the frequency, duration and intensity of these "peaks."

* * *

I hope this addresses the issues of interest to the Subcommittee regarding EPA's asbestos programs, and sets the record straight on the Agency's policies and recommendations relating to asbestos management in the nation's schools. I appreciate the opportunity to discuss these issues and I will be happy to answer any questions that the Subcommittee may have.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

AUG 8 1990

OFFICE OF
PESTICIDES AND TOXIC
SUBSTANCES

Honorable Harry Reid
Chairman
Subcommittee on Toxic Substances,
  Environmental Oversight, Research
  and Development
Committee on Environment and Public Works
Washington, DC 20510

Dear Mr. Chairman:

This is in response to your correspondence concerning the follow-up questions to the April 26 hearing on asbestos in schools before your subcommittee.

Enclosed are the answers to the questions and supporting documents where appropriate.

Sincerely yours,

Linda J. Fisher

Linda J. Fisher
Assistant Administrator

Enclosures

Printed on Recycled Paper

**Question 1:**

Were the plans that were prepared by the schools reviewed by EPA for completeness and accuracy and to see if they meet the standards for a management plan? How many states have reviewed and approved the plans? Were there any problems with the plans? Explain.

**Answer:**

EPA is in the process of conducting an AHERA evaluation which focuses specifically on the quality of management plans. This evaluation is expected to be completed by November 1990 and will provide an indepth and statistically valid approach to judging the quality of management plans.

Under AHERA, states, not EPA, are responsible for reviewing school management plans. At the state level, most states have worked hard to review AHERA management plans and many states have active programs to improve the quality of these plans. All but 2 states have conducted at least some type of review of management plans. Six of these states have conducted reviews which are considered very stringent. Twenty-six states have at least some type of program to help schools improve the quality of their management plans.

Nineteen of the states which are reviewing management plans are using a checklist which EPA developed in the summer of 1988 as part of a series of workshops to train state officials in reviewing management plans.

**Question 2:**

What does EPA know about the quality of management plans? What is EPA doing to make sure that the management plans accurately describe asbestos problems in schools?

**Answer:**

Schools were required to submit their management plans to their state for review. Since at least half of the management plans were submitted to states in May 1989, there has been only a limited time to assess the quality of these plans. EPA, however, is involved in a variety of activities to assess and improve the quality of management plans. These efforts include the ongoing AHERA evaluation, ASHAA project inspections which involve the review of the schools' management plans, and the State Enhancement Initiative which consists of activities such as technical assistance programs which could provide states with funds for management plan improvements, regulatory programs for managing asbestos, and state AHERA-accreditation programs.

Question 3:

Each LEA must begin to implement its plan before July 1989. How are schools doing in implementing their management plans? What guidance do you give schools about the sorts of actions they need to take in order to begin implementation?

Answer:

Management plans were required to become effective July 9, 1989. Based on the management plans submitted with the 1990 ASHAA applications, it appears that LEAs are doing a good job of implementing their management plans.

The Agency has mailed to schools nationwide a variety of informational, guidance and regulatory materials concerning asbestos. EPA worked jointly with NEA and PTA to develop and distribute the pamphlet "ABCs of Asbestos in Schools". Also, we are in the process of developing a resource guide, "Environmental Hazards in Schools" and an operations and maintenance guidance document, "Managing Asbestos In-Place; A Building Owner's Guide to Operations and Maintenance Programs for Asbestos Containing Materials." These two documents are in the final stages and are expected to be available for distribution in late August 1990.

Question 4:

What percentage of schools have, what you would consider, a serious asbestos problem? How did you determine this?

Answer:

EPA has very limited information on this question. In September 1987, EPA prepared a regulatory impact analysis on the schools rule. In this analysis, it was estimated that 20% of all surfacing asbestos-containing material and 27% of all thermal system insulation was significantly damaged. This meant that 25% or more of each surface area was damaged. The information for these estimates was gathered from EPA regional asbestos coordinators.

Question 5:

What percentage of schools have some form of asbestos-containing material in their buildings?

Answer:

In 1984, EPA conducted an Asbestos in Schools Survey (AISS) which estimated the number of schools with asbestos-containing material and the quantity of such material. At the time of the survey 50% of all schools had some thermal system insulation and 40% had surfacing asbestos-containing material.

Question 6:

What is EPA's recommendation to schools that find their buildings have asbestos containing materials in them?

Answer:

Because many people seem to misunderstand EPA requirements and policies on asbestos, and because there have been many erroneous and misleading media reports, EPA is striving to enhance its efforts to get out the message on appropriate asbestos abatement. The message is: Most asbestos-containing materials in schools can be managed properly in-place, particularly if the asbestos is undamaged, not likely to be disturbed and not exposed to building occupants. A very large percentage of asbestos-containing materials in buildings appears to fall within this category. The "ABCs of Asbestos in Schools" and other guidance provides alternatives to asbestos removal.

Question 7:

Other than the ASHAA loan and grant program for asbestos abatement for needy schools, what else does EPA do to help schools with their asbestos problems?

Answer:

EPA has administered five other asbestos financial assistance or cooperative grant programs over the past three years which have helped states or their LEAs. These include grants to states for contractor certification; $1 million in grants to 13 states for AHERA inspector training; $20 million in grants to 31 states under the Asbestos Inspection and Management Plan Assistance Program; $1.5 million to states for various asbestos accreditation and management program enhancements; and EPA provides several million dollars to many states which are willing and able to enforce EPA's schools rule.

Also, EPA has instituted a very comprehensive AHERA compliance assistance program to help schools understand and meet the AHERA requirements. These activities include;

- an easy-to-read checklist guide to the AHERA Schools Rule mailed directly to schools in February 1988;
- a national teleconference in April 1988 via satellite and public television on the new school requirements - tapes are available for school purchase;

- a list of "100 Most Commonly Asked Questions About AHERA" distributed directly to schools in May 1988;
- EPA review and approval of about 19 state AHERA accreditation programs and approximately 1,500 individual AHERA training courses since 1987;
- model training materials for most AHERA-accredited courses, available at no cost;
- technical assistance outreach through EPA's regional offices, utilizing about 45 technical assistants employed through the American Association of Retired Persons (AARP);
- EPA training of state officials at six national locations in July 1988 for review of LEA asbestos management plans; and
- the "ABCs of Asbestos in Schools" mailed directly to LEAs.

Question 8:

The ASHAA loan and grant program expires in 1991. What impact do you believe this will have on needy school systems' asbestos abatement activities? Do you think the ASHAA loan and grant program should be extended, replaced by some other program, or let to expire. Why?

Answer:

The ASHAA loan and grant program expires in 1990. The Administration does not oppose reauthorization of ASHAA, but is concerned this may not be the best use of scarce resources for a problem which is essentially a state and local responsibility. National school groups contend, however, that needy schools will not be able to comply with AHERA unless the ASHAA program continues to provide them financial support.

Question 9:

How much has been spent per year on asbestos management and abatement activities in each state on schools? Can you give us a breakdown of the source of the funds?

Answer:

The Agency does not collect this information. However, in addition to the $243 million that have been awarded under ASHAA for asbestos abatement (see attached charts), the Agency is aware that some states have also provided schools with funds for asbestos management and abatement activities.

Question 10:

Do you have any information on people that acquired an asbestos disease who did not work with asbestos or who did not live with such workers?

Answer:

Nearly all documented cases of asbestos-related disease have occurred as a result of extended occupational exposures to airborne asbestos (e.g., asbestos miners and shipbuilders). A few studies have even shown cases of asbestos-related disease that developed as a result of living with individuals who worked in such occupational settings. Some recent studies also conclude that periodic occupational exposures to airborne asbestos (e.g., building maintenance and janitorial workers) may have contributed to cases of asbestos-related disease. At this time, we are aware of a very limited number of cases of asbestos-related disease caused entirely by low level nonoccupational asbestos exposure. A comprehensive asbestos literature review, now being conducted for EPA by the Health Effects Institute - Asbestos Research (HEI-AR) may shed some additional light on this issue.

The health effects associated with low level nonoccupational exposure to airborne asbestos fibers have usually been inferred by extrapolating data from laboratory and occupational studies. However, as with many other environmental pollutants, the validity of extrapolating from high level exposure to low level exposure has never been demonstrated empirically.

Question 11:

EPA recognizes that better information is needed on asbestos health risks. Is EPA doing anything to develop this information? If so, what is EPA doing and what is your estimate on how long it will take to develop this information?

Answer:

AHERA directs EPA to conduct a study to determine "... the extent of danger to human health posed by asbestos in public and commercial buildings and the means to respond to any such danger." HEI-AR, created on October 9, 1989, has been constituted to help EPA better understand the extent and significance of asbestos exposure in buildings. Congress directed HEI to examine three areas: 1) to determine the "actual airborne exposure levels prevalent in buildings..."; 2) to "characterize peak exposures and their significance..." -- this item pertains to the duration and intensity of disturbances to asbestos by service and maintenance workers and the resulting peak exposure to the workers themselves and, perhaps other building occupants; and 3) to "evaluate the effectiveness of asbestos management andabatement strategies in a scientifically meaningful manner" -- that is, to compare the abatement efficacy of in-place management techniques as opposed to removal.

A literature review may be completed as early as December 1990, and other research will be conducted over the next three to five years. Findings will be made available by HEI-AR as they become available.

Question 12:

Suggestions have been made by some groups that the training requirements for the five different asbestos disciplines (workers, supervisors/contractors, project designers, management planners, and inspectors) should be increased. Does EPA believe the training is adequate at its present level, should be expanded to include more classroom or hands on training or both, or that more rigid testing requirements for certification should be implemented? Why?

Answer:

Because it has been two years since EPA developed its model accreditation plan, we are currently conducting several activities to assess its adequacy, including:

1) Our policy dialogue on asbestos in public and commercial buildings will be bringing participants' accreditation ideas to us. There has been much discussion about performance-based training and testing.

2) EPA has funded the National Asbestos Council (NAC) to review plan criteria and establish, through their offices, a national examination to better ensure qualification and promote consistency and reciprocity among the states. This would supplement, rather than replace, EPA's model accreditation plan.

3) Our AHERA evaluation, due in early 1991, is assessing whether the qualification standards set by the model accreditation plan are sufficient and if response actions in schools are properly conducted.

We will continue to track this issue.

Question 13:

There appears to be a lot of money to be made in the asbestos abatement business. Is there any way an LEA could assure itself that the lower bidder on a job is going to use safe and proper abatement techniques?

**Answer:**

EPA is working with schools to ensure that they have the knowledge necessary to make informed choices regarding the selection of reputable asbestos contractors and concerning the selection of appropriate asbestos abatement techniques.

In the AHERA regulations, EPA cautioned LEAs to be wary of employing one firm both to develop the management plan and to conduct the response action since the management planner's recommendations about response actions could be influenced by the potential profitability of the abatement work.

EPA has provided guidance to schools in selecting asbestos professionals. This guidance includes the following recommendations:

- Consult with your EPA regional asbestos coordinator, who can provide information on potential contractors and appropriate abatement techniques.
- Always check references; speak to other schools that have had asbestos abatement work completed.
- Encourage bidding competition.

One of the most effective ways of ensuring that school officials do not allow unscrupulous abatement contractors to convince them that unnecessary removal is required is to be sure that the school official understands that asbestos removal is often not the most appropriate asbestos abatement technique. EPA is making many efforts to be sure that this message is getting out.

**Question 14:**

How many asbestos training courses are currently approved by EPA? How many of these are conditionally approved? Fully approved? On conditionally approved training courses, how does EPA assure itself that the course meets EPA standards? Conditionally approved courses are fully approved through an audit. How long will it take EPA to audit these courses? Once a course is fully approved what does EPA do to ensure itself that the course continues to offer the required information? How frequently are courses re-audited and what are the criteria for an audit to be initiated?

**Answer:**

EPA has approved approximately 1,500 AHERA accreditation courses. To meet the tight deadlines established by AHERA, EPA had to set up an efficient system to approve courses. Otherwise, we would not have enough accredited persons by October 12, 1988.

Since EPA could not visit all training courses simultaneously, we set up a system to contingently approve courses based on written applications. Almost all of these contingently-approved courses have since been fully approved by EPA after an on-site audit. The Agency plans to conduct an initial audit of all remaining courses with contingent approval as soon as possible. In the long run, we plan to conduct follow-up audits at training courses based on tips, complaints and as a result of our enforcement activities. For example, if our enforcement activities indicate that a number of contractors that have received fines under AHERA have attended the same training course, the Agency will target that course for a follow-up audit.

Question 15:

Is the development of asbestos training courses, preparation of asbestos guidance and manuals and inspections under AHERA performed by EPA personnel or contractors? If any of this work has been contracted out over the past five years, please supply us with the name of each contractor, the tasks contracted for, and the cost of the contract, and the reason EPA contracted out the task and did not perform it in-house?

Answer:

Contractors, under technical direction and oversight by EPA personnel, have helped carry out some of the activities outlined above. All written documents prepared by contractors are thoroughly reviewed by EPA personnel before they are finalized and distributed to the public. Below is a list of those activities which contractors have helped EPA develop over the past five years:

| | | |
|---|---|---|
| o | Asbestos Waste Management Guidance; guidelines for proper handling, transport and disposal of asbestos waste. | 5/85 |
| o | Guidance for Controlling Asbestos-Containing Materials in Buildings; (Purple Book) revised guidance for schools and other building owners. | 6/85 |
| o | Asbestos-in-Buildings: Guidance for Service and Maintenance Personnel; pamphlet for service and maintenance workers on asbestos in buildings. | 7/85 |

| | | |
|---|---|---|
| o | Asbestos in Buildings: Simplified Sampling Scheme for Friable Surfacing Materials; (Pink Book) guidance describing procedures for sampling sprayed- or troweled-on materials on ceilings, walls, and other surfaces. | 10/85 |
| o | Evaluation of Asbestos Abatement Techniques, Phase 1: Removal; examination of the effectiveness of asbestos removal in schools. | 10/85 |
| o | Measuring Airborne Asbestos Following an Abatement Action; (Silver Book) guidance for asbestos program managers in buildings to help them determine when an abatement project is complete and when the abatement contractor can be released. | 11/85 |
| o | Guidance for Preventing Asbestos Disease Among Auto Mechanics; guidance for controlling asbestos exposure to car mechanics. Includes video tape and poster. | 6/86 |
| o | Airborne Asbestos Health Assessment Update; document which provides scientific data and risk management modelling as context for Agency's asbestos policy. | 6/86 |
| o | Evaluation of Asbestos Abatement Techniques, Phase 2: Encapsulation with Latex Paint; examination of the effectiveness of asbestos encapsulation in schools. | 7/86 |
| o | Model Guide Specifications: Asbestos Abatement in Buildings; detailed specifications for contractors to conduct proper asbestos abatement in buildings. Guide developed jointly with National Institute of Building Science. | 7/86 |
| o | A Guide to Respiratory Protection for the Asbestos Abatement Industry; joint EPA/NIOSH guidance for proper respiratory protection for asbestos abatement workers. | 9/86 |
| o | Guidance for Assessing and Managing Exposure to Asbestos in Buildings; draft guidelines for asbestos hazard assessment and response in buildings. | 11/86 |
| o | Model Contractor/Supervisor Course for Ongoing AHERA accreditation; developed by Georgia Tech. Revisions completed in late 1988. | |

| | | |
|---|---|---|
| o | AHERA training course clearinghouse; established central distribution and ordering point for all EPA model accreditation courses. All courses available to the public at cost. | 11/87 |
| o | Model Inspector/Management Planner Course for AHERA Accreditation; Contractor draft of student manual available to public. | 12/87 |
| o | State Asbestos Programs: An Update; guide to State asbestos program activities by the National Conference of State Legislatures (NCSL). Updated in 3/89, 4/90. | 1/88 |
| o | O&M Awareness Video; 2-hour tape developed in cooperation with the American Association of School Administrators and the National Asbestos Council meets AHERA Schools Rule awareness training requirement for schools. | 3/88 |
| o | State Management Plan Review Training; Maryland, Connecticut, Georgia Tech and EPA developed a training program for state officials who will lead state review of AHERA management plans from schools. Several hundred people were trained at six meetings nationwide. | 7/88 |
| o | AHERA Section 210 Study Interim Report to Congress; interim report to Congress on financial assurance for schools and asbestos abatement contractors conducting asbestos hazard abatement activities in school buildings. | 8/88 |
| o | Evaluation of Asbestos Abatement Techniques, Phase 3: Removal; a study to compare airborne asbestos concentrations before, during, and after asbestos removal and to compare measured airborne asbestos concentrations using two different transmission electron microscopy protocols. | 5/89 |
| o | Guidelines for Conducting the AHERA TEM Clearance Test to Determine Completion of an Asbestos Abatement Project; guidance intended for asbestos professionals responsible for interpreting air sampling data. | 5/89 |
| o | Managing Asbestos in Place; an in-place management guide distributed to all schools, | 7/90 |

AHERA training providers, State officials and others.

**Question 16:**

In addition to NESHAP and ASHAA inspections, EPA conducts inspections to ensure that LEAs are complying with AHERA. How many LEAs were inspected for compliance under AHERA in 1989? How many will EPA inspect in 1990?

**Answer:**

EPA regions and states with enforcement cooperative agreements conducted 1,548 inspections for compliance with AHERA in 1989. EPA and states have targeted 1,550 AHERA compliance inspections for FY90.

All but two states have conducted at least some type of review of management plans. Six states have conducted reviews which are considered very stringent. Twenty-six states have at least some type of program to help schools improve the quality of their management plans.

**Question 17:**

What kinds of violations have you found?

**Answer:**

The following types of violations were found during inspections conducted in FY 89:

By LEAs:

- failure to develop a management plan
- failure to submit a management plan

By contractors:

- failure to properly inspect
- non-accredited person conducting response actions

**Question 18:**

When are these inspections being conducted? Before, after, or during the abatement work? How many are conducted as abatement work is actually carried out?

Answer:

Inspections are conducted before, during, or after abatement work, since the AHERA regulations apply to various aspects of asbestos management. For example, the regulations require assessing asbestos levels through required air sampling and analysis procedures conducted at the completion of work; therefore, often compliance inspections are done at the completion of an abatement project. We would inspect at other stages of work if we had information that would warrant investigating a job in progress for worker accreditation, etc. We do not collect data on the number of inspections done at different stages of abatement.

Question 19:

EPA permits states to set up their own compliance monitoring programs through state Cooperative Compliance Agreements. How many states have these agreements? Does EPA monitor the inspections performed under these programs.

Answer:

Currently, EPA has asbestos enforcement cooperative agreements with 15 states. EPA's regional offices are also in the process of completing negotiations for asbestos enforcement grants with 8 other states.

EPA monitors the inspections and other work conducted under enforcement cooperative agreements in at least three ways. First, our EPA regional offices conduct annual mid-year and end-of-year evaluations of all state enforcement grant programs. The end-of-year evaluations tend to be the more extensive reviews. Secondly, for most of the state asbestos enforcement grant programs, our regional offices review the reports from the inspections where violations were found so that enforcement actions can be issued as appropriate. Finally, EPA conducts oversight inspections, whereby an EPA representative goes into the field with a state inspector and observes the conduct of the inspection.

Question 20:

Does EPA require any air monitoring to be performed before an abatement project is started? During the abatement activity? If not, don't you think air monitoring is necessary to determine asbestos levels during these time periods? Explain.

Answer:

EPA's two principal regulations concerning asbestos in buildings, the Asbestos-Containing Materials in Schools Rule (40

CFR Part 763 Subpart E) and the National Emission Standard for Asbestos (40 CFR Part 61 Subpart M), do not require that air monitoring be performed before an asbestos abatement project is started or during the abatement activity, because two other Federal regulations, OSHA's asbestos construction standard (29 CFR Part 1926.58) and EPA's worker protection rule on asbestos (40 CFR Part 763 Subpart G) do require initial and periodic air monitoring during these time periods.

The OSHA asbestos construction standard and EPA's worker protection rule, which extends OSHA's asbestos construction standard to state and local government employees not covered by OSHA, require that employers perform initial air monitoring at the start of each asbestos job to determine the airborne concentration of asbestos that is representative of the exposure of each employee who is assigned to work within a regulated area.

Question 21:

How do you anticipate dealing with the larger question of asbestos in over 700,000 public and commercial buildings?

Answer:

EPA's February 1988 Report to Congress on asbestos-containing materials in public buildings represents a watershed in EPA's asbestos in buildings program. Although the Report did not recommend that EPA propose a comprehensive rule for asbestos in public and commercial buildings, it did recommend that certain steps, listed under "the current program" below, be taken over a three-year period to assess and improve the quality of the nation's asbestos-related activities. EPA stated it would revisit the issue in 1991. A new regulatory program for public and commercial buildings, modeled after the AHERA schools program, was estimated to cost in excess of $50 billion.

The Current Program: Below is a list of those steps recommended in the 1988 Report to Congress and the actions taken so far by EPA to implement them.

1. Enhance the nation's technical capability. The Report identified two major strategies for enhancing the nation's technical capabilities in asbestos management and abatement. First, EPA should increase the number of professionals qualified to perform asbestos management and abatement tasks in buildings. Second, EPA should help building owners better select and apply asbestos management and abatement actions in their buildings.

EPA Actions:

(A) Asbestos training.

- EPA has approved more than 1,500 AHERA accreditation training courses, about 550 laboratories for asbestos analysis, and 22 state accreditation programs.
- With the help of NCSL, EPA has provided states with model accreditation legislation.
- EPA has distributed $2.5 million to 39 states to help them establish abatement contractor and worker certification programs.
- EPA has provided more that $1 million to 17 states to help them develop inspector and management planner accreditation programs.
- EPA has recently provided an additional $1.5 million through its State Enhancement Program to help states develop their own asbestos control and accreditation programs.

(B) Guidance to Building Owners

- In late July 1990 EPA plans to publish an in-place management guide for public and commercial building owners.
- In 1990 EPA plans to complete development of an asbestos management "kit" for federal building managers.

2. Focus attention on thermal system insulation (TSI) asbestos. Since TSI asbestos is more common and more likely to be damaged, the Report recommended that EPA focus some of its technical assistance activities on this material.

EPA Actions:

EPA has consolidated its current knowledge about the presence of TSI asbestos in the nation's buildings through a reanalysis of data collected during EPA's 1984 survey of public and commercial buildings.

In 1990 EPA will develop new guidance and instructional materials on TSI repair and abatement techniques.

3. Improve integration of activities to reduce imminent hazards. The Report recommended improved coordination among the various federal, state, and local agencies responsible for implementing and enforcing existing asbestos regulations.

EPA Actions:

EPA has sponsored the Federal Asbestos Task Force, a working group of officials from federal agencies with asbestos program responsibilities.

In October 1990 EPA plans to issue a final rule revising the current asbestos NESHAP by enhancing the enforcement and compliance provisions in the standard. A second NESHAP revision is also planned.

4. Objectively assess the effectiveness of the AHERA Schools Rule and other current activities. The Report recommended that EPA determine whether the AHERA schools rule approach is working in schools and whether this approach is appropriate for public and commercial buildings. It also recommended that EPA try to fill the data gaps which limit the Agency's ability to make regulatory and programmatic decisions about asbestos in public and commercial buildings.

EPA Actions:

(A) AHERA Evaluation Project. EPA has undertaken a series of studies, to be completed in 1991, which will evaluate the effectiveness of AHERA for schools and assess the efficacy of a similar type of regulation for public and commercial buildings.

(B) HEI Research. EPA's principal effort to learn more about asbestos exposure levels in buildings centers around a joint public-private research project now being conducted under the auspices of HEI. HEI will complete a systematic literature review by early 1991. HEI will complete the research project in 3 to 5 years.

(C) EPA's own research program. EPA has several ongoing and planned research projects which address the efficacy of various asbestos management and abatement techniques.

(D) Policy dialogue. To help determine the most appropriate programmatic or regulatory action with respect to asbestos in public and commercial buildings, EPA has recently concluded a policy dialogue with all affected parties. These groups include:

- Building owners and managers;
- Work groups (Service Employees International Union, Laborers International Union, Sheetmetal Workers, AFSCME, others);
- Federal, state and local government program managers;
- Asbestos abatement and control professionals;
- Former and current manufacturers of asbestos products; and
- Various mortgage bankers, insurers and realty organizations.

## SUMMARY OF THE ASHAA LOAN/GRANT PROGRAM

| TOTAL APPLICANTS | 1985 | 1986 | 1987-1* | 1987-2 | 1988* | 1989 | 1990 | |
|---|---|---|---|---|---|---|---|---|
| LEAs | 1107 | 371 | 292 | 340 | 326 | 1110 | 868 | |
| Schools | 5085 | 1211 | 1090 | 1015 | 966 | 2388 | 1666 | |
| Projects | 8548 | 2369 | 1967 | 1760 | 1722 | 4125 | 3352 | |
| Costs | $535.8M | $211.6M | $162.5M | $177.9M | $170.3M | $367.7M | $408.0M | |
| **TOTAL QUALIFIED APPLICANTS**** | | | | | | | | |
| LEAs | 587 | 241 | 196 | 208 | 165 | 682 | 633 | |
| Schools | 1832 | 644 | 405 | 489 | 441 | 1361 | 1300 | |
| Projects | 2547 | 1247 | 774 | 820 | 721 | 2098 | 2065 | |
| Costs | $186.6M | $93.6M | $41.4M | $94.7M | $79.0M | $123.2M | $282.2M | |
| **TOTAL AWARDEES** | | | | | | | | **TOTALS** |
| LEAs | 198 | 178 | 183 | 35 | 108 | 231 | 120 | 1002 |
| Schools | 340 | 295 | 366 | 66 | 187 | 327 | 166 | 1789 |
| Projects | 417 | 421 | 663 | 66 | 226 | 401 | 206 | 2400 |
| Award | $45M | $47M | $34.2M | $8M | $22.8M | $45M | $48.4M | 248.2M |
| Public Award | $39.8M(88%) | $41.4M(88%) | $29.1M(85%) | $7.32M(91%) | $19.8 (85%) | $40.6M(90%) | $38.6M(82%) | 218.8M(87%) |
| Private Award | $5.2M(12%) | $5.6M(12%) | $5.1M(15%) | 608K (09%) | $2.8M (12%) | $4.4M(10%) | $7.8M(18%) | 31.6M(13%) |
| Loan Award | $33.2M(74%) | $34.3M(73%) | $24.6M(72%) | $4.3M(54%) | $15.4M (66%) | $25.4M(56%) | $29.8M(69%) | 167.0M(68%) |
| Grant Award | $11.8M(26%) | $12.7M(27%) | $9.6M(28%) | $3.7M(46%) | $7.2M (32%) | $19.6M(44%) | $15.6M(31%) | 79.2M(32%) |
| Exposure Hours | 4.7M | 3.8M | 2.6M | 844K | 2.02M | 4.02M | 2.1M | 19.4M |

* Unfunded applications from 1986 were the only projects considered for 1987-1 awards. Unfunded applications from 1987-2 were the only projects considered for 1988 awards.

**ACM is friable, damaged, and exposed (or in an air plenum) and LEA is within lower 70% of country's school districts, based on per-capita income (public) or budget per pupil (private). Reflects those determined to be "qualified" after EPA's technical review.

A9. Loan & Grant Program

| State Name | 06-Jun-85 | 31-Jul-86 | 01-Apr-87 | 29-May-87 | 01-Mar-88 | 29-Apr-89 | 4-May-90 | All Years |
|---|---|---|---|---|---|---|---|---|
| Alabama | 260,310.00 | 270,543.00 | 461,840.00 | 0.00 | 413,170.00 | 0.00 | 99,402.00 | 1,505,265.00 |
| Alaska | 750,000.00 | 120,520.32 | 0.00 | 0.00 | 0.00 | 34,821.00 | 116,463.00 | 1,021,804.32 |
| American Samoa | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Arizona | 102,492.74 | 431,020.00 | 127,230.00 | 100,121.00 | 0.00 | 124,232.00 | 0.00 | 885,095.74 |
| Arkansas | 293,302.50 | 265,041.00 | 109,179.00 | 400,665.00 | 1,684,136.00 | 587,975.00 | 586,894.00 | 3,927,192.50 |
| BIA | 233,925.00 | 264,434.37 | 26,749.00 | 235,752.00 | 113,752.00 | 0.00 | 375,000.00 | 1,249,612.37 |
| California | 261,693.00 | 439,928.00 | 306,249.00 | 0.00 | 212,580.00 | 3,192,152.00 | 6,222,828.00 | 10,635,430.00 |
| Colorado | 701,763.00 | 132,676.22 | 0.00 | 0.00 | 0.00 | 786,715.00 | 432,104.00 | 2,053,278.22 |
| Connecticut | 472,400.00 | 2,289,884.00 | 2,457,992.00 | 0.00 | 0.00 | 240,617.00 | 15,351.00 | 5,476,244.00 |
| Delaware | 263,200.00 | 0.00 | 0.00 | 0.00 | 0.00 | 70,604.00 | 0.00 | 333,804.00 |
| DC | 284,000.00 | 3,160.00 | 0.00 | 10,537.00 | 0.00 | 0.00 | 31,841.00 | 329,538.00 |
| Florida | 54,496.76 | 0.00 | 0.00 | 80,007.00 | 0.00 | 28,800.00 | 35,900.00 | 199,203.76 |
| Georgia | 553,090.80 | 0.00 | 0.00 | 0.00 | 0.00 | 196,844.00 | 139,394.00 | 889,328.80 |
| Guam | 0.00 | 46,643.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 46,643.00 |
| Hawaii | 0.00 | 0.00 | 0.00 | 309,877.00 | 0.00 | 0.00 | 0.00 | 309,877.00 |
| Idaho | 305,535.30 | 164,092.43 | 0.00 | 275,799.00 | 99,630.00 | 238,327.00 | 287,346.00 | 1,370,729.73 |
| Illinois | 1,261,786.00 | 2,028,226.30 | 2,645,750.00 | 0.00 | 4,019,226.00 | 9,188,440.00 | 11,327,623.00 | 30,471,000.30 |
| Indiana | 366,193.44 | 82,445.83 | 0.00 | 66,465.00 | 0.00 | 4,266,993.00 | 1,129,362.00 | 5,911,459.27 |
| Iowa | 470,135.85 | 823,910.76 | 521,701.00 | 0.00 | 368,564.00 | 249,233.00 | 361,868.00 | 2,795,412.61 |
| Kansas | 220,196.64 | 251,650.00 | 45,368.00 | 0.00 | 0.00 | 98,333.00 | 360,409.00 | 975,956.64 |
| Kentucky | 1,585,150.19 | 1,894,733.12 | 97,215.00 | 304,347.00 | 1,837,719.00 | 697,322.00 | 527,974.00 | 6,944,460.31 |
| Louisiana | 2,294,573.00 | 1,449,573.99 | 657,221.00 | 0.00 | 1,188,385.00 | 240,469.00 | 1,391,994.00 | 7,220,215.99 |
| Maine | 158,160.00 | 113,357.00 | 0.00 | 258,165.00 | 0.00 | 65,223.00 | 0.00 | 594,905.00 |
| Maryland | 1,549,252.00 | 3,889,275.21 | 332,176.00 | 0.00 | 80,000.00 | 165,450.00 | 553,264.00 | 6,569,426.21 |
| Massachusetts | 465,840.00 | 2,125,966.50 | 4,273,079.00 | 0.00 | 0.00 | 149,964.00 | 1,212,748.00 | 8,167,597.50 |
| Michigan | 816,325.00 | 1,308,542.00 | 2,836,926.00 | 0.00 | 378,419.00 | 1,187,865.00 | 1,120,564.00 | 7,648,641.00 |
| Minnesota | 617,040.00 | 726,178.22 | 2,076,221.00 | 0.00 | 283,169.00 | 760,251.00 | 1,024,220.00 | 5,407,079.22 |
| Mississippi | 483,211.00 | 2,237,434.93 | 405,805.00 | 0.00 | 1,046,525.00 | 1,553,649.00 | 2,356,880.00 | 8,083,504.93 |
| Missouri | 590,890.00 | 1,144,427.99 | 784,674.00 | 0.00 | 978,139.00 | 504,315.00 | 530,594.00 | 4,533,039.99 |
| Montana | 395,400.00 | 0.00 | 0.00 | 0.00 | 0.00 | 217,204.00 | 240,294.00 | 852,898.00 |
| Nebraska | 301,534.91 | 252,191.66 | 143,882.00 | 208,476.00 | 12,350.00 | 823,196.00 | 613,787.00 | 2,355,417.57 |
| Nevada | 1,563,293.00 | 103,154.49 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1,666,447.49 |
| New Hampshire | 299,622.14 | 0.00 | 0.00 | 680,000.00 | 200,826.00 | 412,433.00 | 278,045.00 | 1,870,926.14 |
| New Jersey | 2,205,792.47 | 1,170,903.58 | 2,723,174.00 | 0.00 | 664,661.00 | 234,408.00 | 821,001.00 | 7,846,218.05 |
| New Mexico | 0.00 | 245,427.75 | 5,775.00 | 170,638.00 | 0.00 | 32,016.00 | 0.00 | 453,856.75 |
| New York | 1,476,074.00 | 2,162,205.25 | 451,387.00 | 2,977,135.00 | 682,581.00 | 1,864,514.00 | 2,423,624.00 | 11,657,520.25 |
| North Carolina | 1,350,000.00 | 528,870.00 | 1,423,306.00 | 0.00 | 0.00 | 99,469.00 | 241,389.00 | 3,643,034.00 |
| North Dakota | 300,774.10 | 309,861.00 | 166,002.00 | 481,961.00 | 43,049.00 | 592,804.00 | 247,905.00 | 2,112,356.10 |
| Northern Marianas | 39,788.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 39,788.00 |
| Ohio | 6,251,716.05 | 6,075,857.22 | 8,157,221.00 | 0.00 | 4,431,241.00 | 3,437,151.00 | 2,223,247.00 | 30,576,433.27 |
| Oklahoma | 507,538.00 | 92,081.25 | 0.00 | 0.00 | 0.00 | 177,767.00 | 6,150.00 | 783,536.25 |
| Oregon | 274,097.00 | 12,144.00 | 0.00 | 72,764.00 | 0.00 | 4,144,205.00 | 390,875.00 | 4,894,085.00 |
| Pennsylvania | 4,042,134.12 | 6,118,934.06 | 1,754,861.00 | 0.00 | 487,612.00 | 1,724,631.00 | 319,947.00 | 16,455,519.18 |
| Puerto Rico | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Rhode Island | 484,000.00 | 225,491.58 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 709,491.58 |
| South Carolina | 309,215.08 | 182,250.00 | 0.00 | 501,000.00 | 0.00 | 57,328.00 | 241,641.00 | 1,271,434.08 |
| South Dakota | 130,278.89 | 0.00 | 0.00 | 196,090.00 | 0.00 | 394,576.00 | 289,222.00 | 1,010,166.89 |
| Tennessee | 1,075,389.00 | 3,565,551.65 | 1,418,409.00 | 0.00 | 1,800,462.00 | 3,297,095.00 | 3,744,300.00 | 14,939,306.65 |
| Texas | 5,133,312.67 | 411,673.00 | 1,091,090.00 | 0.00 | 446,122.00 | 1,232,085.00 | 702,627.00 | 9,016,909.67 |
| TT | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Utah | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 167,260.00 | 0.00 | 167,260.00 |
| Vermont | 268,845.50 | 287,593.00 | 62,464.00 | 46,245.00 | 16,500.00 | 302,219.00 | 175,279.00 | 1,159,145.50 |
| Virgin Islands | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Virginia | 0.00 | 208,902.07 | 0.00 | 173,630.00 | 0.00 | 269,600.00 | 294,101.00 | 946,233.07 |
| Washington | 279,778.65 | 14,008.12 | 0.00 | 282,571.00 | 117,409.00 | 237,766.00 | 736,613.00 | 1,648,145.77 |
| West Virginia | 427,362.50 | 333,350.00 | 297,848.00 | 0.00 | 127,750.00 | 237,997.00 | 40,954.00 | 1,465,261.50 |
| Wisconsin | 310,027.11 | 271,886.10 | 341,960.00 | 0.00 | 899,785.00 | 254,491.00 | 340,756.00 | 2,418,905.21 |
| Wyoming | 299,124.05 | 0.00 | 0.00 | 210,865.00 | 0.00 | 63,924.00 | 0.00 | 573,913.05 |
| | 45,000,000.00 | 47,000,000.00 | 34,282,784.00 | 8,000,000.00 | 22,000,000.00 | 45,000,000.00 | 43,443,000.00 | 245,325,784.00 |

## Asbestos in Schools Hazard Abatement Act

### Awards by State -- ASHAA 1990

| State | Award | Projects |
|---|---:|---:|
| Alaska | $ 116,463 | 7 |
| Alabama | 99,402 | 5 |
| Arkansas | 506,894 | 2 |
| Arizona | 0 | 0 |
| Bureau of Indian Affairs | 375,000 | 1 |
| California | 5,222,828 | 8 |
| Colorado | 432,184 | 5 |
| Connecticut | 15,351 | 2 |
| District of Columbia | 31,841 | 2 |
| Delaware | 0 | 0 |
| Florida | 36,960 | 3 |
| Georgia | 139,394 | 6 |
| Hawaii | 0 | 0 |
| Iowa | 361,868 | 3 |
| Idaho | 287,346 | 10 |
| Illinois | 11,327,623 | 18 |
| Indiana | 1,129,362 | 5 |
| Kansas | 360,409 | 2 |
| Kentucky | 527,974 | 1 |
| Louisiana | 1,391,994 | 3 |
| Massachusetts | 1,212,748 | 2 |
| Maryland | 553,264 | 2 |
| Maine | 0 | 0 |
| Michigan | 1,120,564 | 1 |
| Minnesota | 1,024,220 | 4 |
| Missouri | 530,594 | 4 |
| Mississippi | 2,356,880 | 10 |
| Montana | 240,294 | 8 |
| North Carolina | 241,389 | 10 |
| North Dakota | 247,905 | 4 |
| Nebraska | 613,787 | 2 |
| New Hampshire | 278,045 | 3 |
| New Jersey | 821,001 | 4 |
| New Mexico | 0 | 0 |
| Nevada | 0 | 0 |
| New York | 2,423,624 | 6 |
| Ohio | 2,223,247 | 22 |
| Oklahoma | 6,150 | 1 |
| Oregon | 300,875 | 1 |
| Pennsylvania | 319,947 | 2 |
| Puerto Rico | 0 | 0 |
| Rhode Island | 0 | 0 |
| South Carolina | 241,641 | 2 |
| South Dakota | 289,222 | 3 |
| Territories/Virgin Is. | 0 | 0 |
| Tennessee | 3,744,380 | 13 |

## Asbestos in Schools Hazard Abatement Act

### Awards by State -- ASHAA 1990

| State | Award | Projects |
|---|---|---|
| Texas | $ 702,627 | 5 |
| Utah | 0 | 0 |
| Virginia | 294,101 | 2 |
| Vermont | 175,279 | 7 |
| Washington | 736,613 | 1 |
| Wisconsin | 340,756 | 3 |
| West Virginia | 40,954 | 1 |
| Wyoming | 0 | 0 |
| | 43,443,000 | 206 |

# TESTIMONY
# BEFORE THE UNITED STATES SENATE
# ENVIRONMENT COMMITTEE

Thursday, April 26, 1990

HENRY LEE
Executive Director
Energy and Environmental Policy Center
John F. Kennedy School of Government
Harvard University
Cambridge, MA

Mr. Chairman, Members of the Committee, my name is Henry Lee. I am the Executive Director of Harvard's Energy and Environmental Policy Center. I am also one of four co-authors of the report summarizing the "Symposium on the Health Aspects of Exposure to Asbestos in Buildings" held at Harvard University in December of 1988. I am not a scientist nor do I profess to have any expertise in the field of medicine. My career has been exclusively in the field of energy and environmental policy. I would also state that I have never done any work for either side in the asbestos debate.

I would like to begin by briefly reviewing the conclusions of our symposium.

Its purpose was to bring together experts from the United States, Canada and Europe to examine the present state of scientific knowledge on the health risks of exposures to asbestos fibers in buildings. Approximately forty of the top scholars and experts in the field participated in this three-day event. The summary report represented a synthesis of the discussions which took place. While this document is not a compendium of new research, its conclusions are supported by technical papers which have been published by the Center.

Since the publication of this report, many of the symposium's conclusions have been taken out of context and exaggerated by those who found them to be at odds with their pre-established positions. I hope this review will set the record straight.

## Asbestos Types

First, not all asbestos fibers are alike. A majority of the relevant studies indicate that respirable fibers longer than 5 µm (primarily amphiboles) present a much greater risk of mesothelioma than shorter fibers (chrysotile). The Harvard symposium did not claim that shorter fibers have no risks nor did we claim that there are no remaining scientific uncertainties. In fact, we strongly support the Health Effects Institute Study which will strive to remove some of these uncertainties.

## Exposures

Secondly, health risk is a function of exposures. If a person is not exposed to a pollutant, the health risk to that individual is zero. Therefore, in order to determine the relative risk of a pollutant or toxic material one must first calculate the level of exposures. This is not always easy to do. There are inconsistencies between exposure studies, and these often result in heated disagreements among the experts.

EPA studies of building occupants, however, have shown that exposures to fibers 5 µm and longer inside buildings are often no more, and in some cases even less, than exposures to outdoor airborne concentrations of all fibers.

Most homes have toxic materials in storage as cleansers or fuels. No one feels that their existence constitutes a risk. Rather, we worry about exposures when these materials are used or, to be more precise, misused. For there to be a risk to human health, asbestos fibers must be released into the air and people must breath that air.

Recent data, including data taken from EPA studies, indicate that the average concentration of asbestos in schools and other buildings is generally below the 0.001 (mixed) fibers/ml used in risk calculations performed for school children. Using conservative risk models and exposure assumptions, the projected lifetime risk from exposure to mixed asbestos fibers is one death among a cohort of 100,000 building occupants. The Committee should understand that this figure represents risks not actual deaths. In comparison to other environmental hazards, this risk is very low.

Third, common sense tells us that certain groups who work in buildings may either deliberately -- ie. asbestos removal workers -- or inadvertently -- ie. service workers -- release asbestos fibers into the air. These people by definition will incur much greater exposure levels and thereby much greater risks.

## Removal May Increase Risks

Removal operations may increase rather than decrease indoor asbestos concentrations and the associated health risks. In many instances, removal is not the best course of action to reduce asbestos exposures. Sampling in post abatement areas evaluated by EPA has shown increased fiber levels three to six times over pre-abatement concentrations. In fact, one study found fiber levels increasing 10-100 times after incomplete dry removal of asbestos materials. This leads one to the conclusion that in some cases an action to reduce environmental risks -- asbestos removal -- may in fact increase such risks. Thus if one is in the risk reduction business, one might in certain circumstances aggressively act to prevent asbestos removal.

## Dangers for Asbestos Removers

Those individuals engaged in the job of removing asbestos are at much higher risk than the general population. While it may be true that more can be done to train these individuals, provide them with better protection, and to enforce existing EPA and OSHA standards, the harsh reality is that to be employed in the asbestos removal business is almost certainly to expose oneself to much higher concentrations of asbestos fibers. Can anyone guarantee that every asbestos removal worker will keep his or her respirator on for eight hours each and every work day no matter how uncomfortable? If exposures are the key to risk, then the exposure levels of an average asbestos removal worker receives in six months on the job must be substantially higher than the average exposure level for school children, teachers or office occupants over many years in buildings with in-place asbestos.

In summary, the Harvard symposium concluded that:

1) There are some risks from exposure to all asbestos fibers, but that these risks seem to differ in magnitude according to fiber size and type.

2) Occupant risks are related to exposures and these exposures are usually very low. This is not the case, however, for individuals in the asbestos removal business and in certain circumstances may not be the case for service employees. These individuals need more protection -- not less.

3) The act of removing asbestos from a facility can exacerbate the health risk to all three of these populations. Removal should only be conducted when other asbestos management remedies have been shown to be inadequate.

## Policy Conclusions

The American public is bombarded daily with ominous reports about the health risks of various substances. People do not want to get cancer, and certainly they do not want their children to be exposed to materials which might cause cancer, and therefore these reports cause considerable anxiety. Further, people do not have a framework for discerning which of these many threats are more serious than others. In most instances, public concern is a direct function of publicity. The more media coverage an issue receives, the greater will be the public's anxiety. This anxiety in turn pressures government agencies to divert resources -- sometimes from more serious environmental threats -- to deal with these problems. The end result is sometimes a misallocation of both anxiety and public resources, which in turn results in much lower levels of environmental protection. In these instances, no one wins.

In the case of asbestos fibers, there is certainly a high level of public anxiety. In many cases this anxiety translates into massive and expensive programs to unnecessarily remove in-place asbestos. Public health is not incrementally improved, and in many instances might be reduced. This is not an ideal situation.

## What can be done about it?

I would suggest two basic rules of thumb. First, government efforts should be directed at those populations which are at greatest risk from exposures to asbestos fibers. The primary group that falls within this category are asbestos removal workers. By definition, these individuals are consistently exposed to friable asbestos materials. Government agencies should ensure that these men and women receive proper training, equipment, and working conditions.

The next most vulnerable -- or exposed -- group are service personnel who in the conduct of their job responsibilities sometimes accidentally disturb in-place asbestos or who inadvertently come in contact with previously disturbed asbestos materials. While there exposures are episodic, their risks are certainly higher than those for general occupants. Therefore, a reasonable asbestos management program should focus on informing these workers where asbestos material is located, what procedures to take to avoid disturbing in-place asbestos, and what precautions are necessary if and when that asbestos is disturbed.

Whether government should enforce development of such a program depends on the answers to three questions: What is the frequency of these events; what are the subsequent exposure levels; and how willing are building owners to provide basic information and training. Hopefully, EPA through the Health Effects Institute study or through other research efforts can produce credible answers to these questions and make recommendations as to whether Congress should proceed to expand the pre-existing array of asbestos management programs.

The second rule of thumb is that asbestos programs should maximize public health and should do so at a reasonable cost. That is, once government has set targets for public health, then government should meet those targets in the most cost effective manner. The implementation plan should not determine environmental goals.

Asbestos management does not necessarily mean asbestos removal. Removal is only one of many implementation options. As I have shown in the earlier part of my testimony, it can, in many cases, increase not decrease environmental risks.

When one is dealing with public buildings such as schools, we are talking about spending tax dollars, and there is not an unlimited stream of such dollars. To spend these funds on activities that might not improve public health does not constitute a reasonable public expenditure. There has to be an emphasis on developing optimal asbestos management programs, not necessarily optimal asbestos removal programs. Admittedly, in some instances removal may be necessary. I am simply saying that it often carries with it a large fiscal and environmental cost, and therefore governments should be judicious in its willingness to improve those costs. If removal will significantly reduce the risks to the public, remove the asbestos. If there are doubts that public health will be improved, one would be wise to proceed much more cautiously.

Finally, we expect government agencies to warn us about environmental dangers, and we are critical of the Environmental Protection Agency when it does not provide timely notification of environmental threats. I think this is a legitimate expectation. In the same fashion, however, it is incumbent upon governments to reduce anxieties and fears, if they find that good science does not support such fears.

In the case of asbestos, I would urge the Environmental Protection Agency to establish guidelines for schools which warn of both the dangers and the benefits of asbestos removal.

## Summary

Congress and EPA should base their asbestos policies on a firm foundation of scientific fact and should utilize those facts to determine the actual risks to various populations. It should target its programs at those populations which are at greatest risks and design those programs in the most cost effective manner possible.

EPA is making significant strides in this direction, and I would urge this committee to support their efforts. I do believe, however, that more emphasis should be placed on protecting asbestos removal workers and that greater efforts should be made to educate school districts and building managers to the fact that in many instances in-place asbestos carries with it very low risks to building occupants and that removal may in many instances create greater rather than lesser risks.

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

National Institute for
Occupational Safety and Health
Centers for Disease Control
Atlanta GA 30333

Statement By

Richard A. Lemen

Assistant Director

National Institute for Occupational Safety and Health

Centers for Disease Control

U.S. Public Health Service

Department of Health and Human Services

Before the

Subcommittee on Toxic Substances, Environmental

Oversight, Research and Development

Committee on Environment and Public Works

Thursday, April 26, 1990

I am pleased to testify on the science and the health effects caused by exposures to asbestos. I am currently Assistant Director of the National Institute for Occupational Safety and Health (NIOSH). I have been involved with the study of occupational exposures to asbestos since 1970. I am also the primary author of the NIOSH recommended standard for occupational exposure to asbestos, the asbestos monograph published by the International Agency for Research on Cancer, and numerous articles on asbestos in the scientific literature. I have attached a copy of my complete curriculum vitae.

Asbestos is a generic term referring to a group of naturally occurring fibrous minerals that are commercially prized for their thermal and insulative properities, in addition to their flexibility, durability and tensile strength. Because of these characteristics, asbestos is highly persistent in the human body once inhaled or ingested.

Based on studies of workers who were heavily and regularly exposed to asbestos before general government regulation of the workplace, we know that asbestos causes specific diseases such as asbestosis, an irreversible and progressively disabling lung disease which impairs breathing, and mesothelioma, an invariably fatal cancer of the lining of the chest, pericardium, or abdominal cavity. Asbestos is one of the leading causes of lung cancer in non-smokers. Asbestos exposure for smokers increases the risk of lung cancer approximately 55 times that of those who are not exposed to asbestos and who do not smoke. Asbestos is also associated with an increased risk of gastrointestinal and other cancers.

The conclusion drawn by many experts, in this and other countries, and best summarized in the 1987 Supplement of the World Health Organization's International Agency for Research on Cancer, is that ". . . occupational exposure to chrysotile, amosite and anthophyllite asbestos and to mixtures containing crocidolite results in an increased risk of lung cancer, as does exposure to minerals containing tremolite and actinolite and to tremolitic material mixed with anthophyllite and small amounts of chrysotile. Mesotheliomas have been observed after occupational exposure to crocidolite, amosite, tremolitic material and chrysotile asbestos. Gastrointestinal cancers occurred at an increased incidence in groups occupationally exposed to crocidolite, amosite, chrysotile or mixed fibres containing crocidolite, although not all studies are consistent in this respect. An excess of laryngeal cancer has also been observed in some groups of exposed workers. No clear excess of cancer has been associated with the presence of asbestos fibres in drinking water. Mesotheliomas have occurred in individuals living in the neighbourhood of asbestos factories and mines, and in people living with asbestos workers."

Recent reports have appeared in the scientific literature to suggest that different forms of asbestos are not equally pathogenic (Mossman and Gee, 1989 and Mossman et al., 1990). However, there is a great deal of uncertainty associated with these findings and equally important contradictory evidence. Results from research involving animal bioassays present a strong case that there is no safe form of asbestos. Wagner et al. (1979), then with the United Kingdom's Medical Research Council, have shown that a commercial grade, predominantly short-fiber Canadian chrysotile (a purportedly less hazardous form of asbestos), and an ingredient used primarily in paint and in plastic tile fillers, induces mesotheliomas when injected intrapleurally into rats, and induces primary lung neoplasms in rats exposed by inhalation. Not only has chrysotile been found to be as potent as crocidolite and other amphiboles in inducing mesotheliomas when injected intrapleurally (Wagner et al., 1973), it has been found equally potent in inducing pulmonary neoplasms through inhalation exposures (Wagner et al., 1974). Chrysotile also appears to be more potently fibrogenic and carcinogenic than amphiboles, in relation to the quantity of dust deposited and retained in the lungs of rats (Wagner et al., 1974).

There is the hypothesis that chrysotile is less hazardous because of its chemical and biological reactivity. In fact chrysotile fibers are much more chemically and biologically reactive than amphibole fibers (Davis et al., 1978; Davis et al., 1986a; and Davis et al., 1986b). In contact with body tissues, chrysotile fibers lose their structural elements and divide into smaller fibrils, making their recognition difficult by the usual analytical methods. In fact, many of the fibers are removed from the lungs to other organs in the body and up through the bronchi. These findings also support the hypothesis that chrysotile fibers cause cellular injury, fibrosis and lung cancer. These fibers are less readily detected in the tissue after the damage is done. The concentration of dust in the lungs of rats exposed to

Canadian chrysotile (Wagner et al., 1974) was only 1.8% to 2.2% of the dust concentration in the lungs of animals exposed to amphiboles, after 24 months of inhalation exposure. Yet the lung tumor incidences and degree of pulmonary fibrosis were similar among groups of rats exposed to different forms of asbestos.

At this time, there is no compelling evidence to justify different public health policy for different asbestos fiber types. The reason for higher incidence of lung cancer and mesothelioma in workers exposed to amphiboles is probably related to higher concentrations of respirable fibers during their exposures (NIOSH, 1979). Furthermore, most commercially exploited deposits of chrysotile are contaminated with some type of the amphibole form of asbestos (Bartlett, 1988 and Campbell, 1988).

Other international expert groups have reached similar conclusions regarding the uncertainty of the hypothesis that some forms of asbestos may be less hazardous. In a recently released document from an expert panel convened by the World Health Organization in 1989, the panel concluded: "it is difficult to substantiate this difference [in pathogenicity] firmly after standardization for exposure levels, type of industry, duration of employment, etc." This conclusion agrees with the findings of the 1984 report of the Canadian Royal Commission on Matters of Health and Safety Arising from the Use of Asbestos in Ontario. The Commission recommended that textile manufacturing using a form of asbestos purported to be less hazardous (chrysotile) be banned, and concluded that "all fiber types can cause all asbestos-related diseases."

The Centers for Disease Control (CDC) through NIOSH has recently submitted to Occupational Safety and Health Administration (OSHA) on April 8, 1990 a reiteration of its previous testimony of June 21, 1984, that ". . . there is no safe concentration for exposure to asbestos." Not even the lowest exposure limit for asbestos could assure all workers absolute protection from exposure-related cancer. OSHA projects that at the current occupational standard for asbestos of 0.2 fibers/cc over a working lifetime, 67 cancers for every 1,000 exposed workers can be expected to develop (OSHA, 1986). In the April 8, 1990 submittal to OSHA, CDC through NIOSH also reaffirmed its position that there is no scientific basis for differentiating between types of asbestos fibers for regulatory purposes. The scientific evidence to date suggests that fiber morphology (size and shape) is the most critical factor in the pathogenicity of the material and as such the most prudent public health policy is to regulate asbestos based upon its morphology and not on its mineralogic source.

I would be happy to answer any questions the subcommittee may have.

# CURRICULUM VITAE

## RICHARD A. LEMEN

## PERSONAL DATA

**Date of Birth**: 23 July 1943

**Current Occupational Status**:

Regular Corps Appointment:
Captain O-6, United States Public Health Service (USPHS)
Assistant Director
National Institute for Occupational Safety and Health, (NIOSH), Centers for Disease Control (CDC), 200 Independence Ave., S.W., Rm. 714B, Washington, D.C. 20201

## EDUCATIONAL BACKGROUND

| | Major Area | Degree | Date |
|---|---|---|---|
| Central Methodist College | Zoology-Chemistry | B.A. | 1967 |
| University of Missouri | Epidemiology | M.S.P.H. | 1970 |
| University of Minnesota | Epidemiology | (Summer Seminars) | 1971 |
| University of Illinois | Occupational Medicine, Special Training | | 1976-1978 |
| University of Cincinnati | Epidemiology | Ph.D. Candidate | Present |

## PROFESSIONAL CAREER - JOB DESCRIPTION

### NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

| Date | Agency | Job Title |
|---|---|---|
| October 1988 - Present | National Institute for Occupational Safety And Health (NIOSH) | Assistant Director |

I serve as Assistant Director of the National Institute for Occupational Safety and Health in Washington, D.C. and I serve as the Assistant Director for the Centers for Disease Control (CDC) Washington, D.C. Office.

NIOSH has an annual budget of $85 million and approximately 815 positions. I serve as Director of the Institute at the request of the Director, NIOSH. I plan, manage, schedule and assign work to various organizational component's of the Institute and delegate authority to subordinate supervisors and evaluate their performance. In addition, I determine and set program priorities and goals. In the capacity of Assistant Director of the CDC Washington, D.C. office, I serve as alternate agency representative to the office of the Surgeon General, United States Public Health Service.

In this position, I represent and act for the Director of NIOSH in contacts with high level officials in the Office of the Secretary of the Department of Health and Human Services, the Office of the Assistant Secretary for Health as well as other Departmental offices in both informal interaction and in formal policy formulation meetings. In addition, I am in frequent direct communication with members of Congress and their staffs; high ranking officials of extragovernmental health agencies; national and international health leaders; national and international union and trade association leaders; high ranking officials of other federal agencies including the Office of Management and Budget and the White House. I am also the NIOSH liaison to various international and national labor unions; state; city; and county health and labor agencies. I am also the direct liaison for NIOSH with the Assistant Secretary for Labor's Office for Occupational Safety and Health (OSHA) and to the Assistant Secretary for Labor's Office for Mine Safety and Health (MSHA). I also represent the Director of NIOSH to representatives of various foreign embassies and other organizations to explain, defend, negotiate and settle issues of major consequences to NIOSH's mission. These interactions frequently require consensus development form initially varying views.

I serve as a Principle member of the NIOSH Director's senior management team using my epidemiology training and a broad knowledge of public health and of occupational safety and health in participating in the development of Institute-wide policies, program priorities, organizational management and resource allocation and deployment.

I am responsible for assuring the proper development of proposed testimony for congressional hearings on issues affecting NIOSH. In the absence of the Institute Director and with the approval of the CDC Director and other Department Officials I present such testimony. In addition, I interpret to the Congress and to the Department, the implications of pending legislation or regulations pertaining to occupational safety and health issues.

## Division of Standards Development and Technology Transfer

| Date | Agency | Job Title |
|---|---|---|
| August 1981 -<br>September 1988 | Division of Standards Development and Technology Transfer, NIOSH, CDC, PHS | Director |

In this position my job is to: (1) develop from existing scientific and technical information documents containing (a) criteria for recommended occupational safety and health standards, and (b) technical and scientific information relevant to a variety of occupational safety and health issues; (2) develop recommended health standards under the Federal Mine Safety and Health Act of 1977; (3) in cooperation with the U.S. Department of Labor, coordinate NIOSH Testimony at the Department of Labor hearings on proposed standards to support scientific and technical consideration; (4) assist the Director, NIOSH, in establishing a priority system for research, document development, and recommended standards; (5) prepare and annually revise the legislatively mandated toxic substances list; (6) conduct a clearinghouse for receiving, storing, retrieving, and disseminating technical information on occupational safety and health; (7) and provide statistical methodology review for NIOSH research activities. I am responsible for managing 85 staff positions, with an annual budget of $3.9 million.

## Division of Criteria Documentation and Standards Development

| Date | Agency | Job Title |
|---|---|---|
| June 1980 - July 1981 | Division of Criteria Documentation and Standards Development and Division of Technical Services, NIOSH, CDC, PHS | Director |

## Division of Criteria Documentation and Standards Development

In this position I was responsible for providing recommendations to the Director of NIOSH for the development of safety and health criteria and standards, so that meaningful recommendations could be made by the Department of Health and Human Services to the Department of Labor. Also, I established, coordinated, and maintained an in-depth working relationship with individuals responsible for directing the Institute's research programs.

I helped to define and communicate both general and specific research needs as they related to the development of criteria for national standards, which required fundamental understanding of the technical considerations, as well as the basic philosophies that encompass the field of occupational safety and health, to insure that in developing recommended standards all options are reviewed and tested for effectiveness. As final reviewer of all criteria documents and recommended standards before transmittal for approval to the Director of NIOSH, I assessed the total project and its usefulness in job safety and health.

In addition, I developed and maintained open channels of communication with industry, organized labor, and national and international professional organizations to identify anticipated problem areas, as well as becoming aware of other research being conducted.

## Division of Technical Services

In this Division I developed technical assistance strategies and resources for program development at the Federal, state, and local levels; prepared and revised annually the legislatively mandated toxic substances list;

administered a clearinghouse for receiving, storing, retrieving, and disseminating technical information on occupational safety and health hazards; developed guidelines for the classifications of occupational disease in compensation programs; promoted and provided technical guidance in the development of occupational safety and health programs at the state and local government levels, as well as in industry; analyzed and related the practice of occupational medicine in industry with the total delivery of health services; developed innovative methods, techniques, and approaches for dealing with occupational safety and health problems; and provided statistical services for Institute research activities.

**Division of Surveillance, Hazard Evaluation and Field Studies**
**Industrywide Studies Branch - Biometry Section**

| Date | Agency | Job Title |
|---|---|---|
| April 1976 - September 1976 | Biometry Section, IWSB, DSHEFS, NIOSH, CDC | Chief, Biometry Section |
| January 1974 - April 1976 | Biometry Branch, DFSCI, NIOSH, CDC | Chief, Biometry Branch |

As Chief of the Biometry Branch, Division of Field Studies and Clinical Investigations, my major responsibility was to provide the administrative direction for all biostatistical and epidemiological analyses of ongoing industry-wide studies in the Division. The staff consisted of approximately 40 professional and nonprofessional personnel. The annual operations budget was approximately $1,328,500.

**Division of Surveillance, Hazard Evaluation and Field Studies**
**Biometry Branch**

| Date | Agency | Job Title |
|---|---|---|
| July 1971 - December 1973 | Biometry Branch, DFSCI, NIOSH, CDC | Epidemiologist |

In this position, I was responsible for conducting several retrospective cohort studies on workers who were exposed to such substances as Asbestos, Bis(chloromethyl)Ether, Cadmium, Benzidene, Beta-Naphthylamine, Carbon Monoxide, Methyl Ethyl Ketone, Methyl Butyl Ketone, and Talc (a variety of other studies were included).

**Field Studies Bureau**

| Date | Agency | Job Title |
|---|---|---|
| September 1970 - July 1971 | Field Studies Bureau, Occupational Safety and Health, U.S.P.H.S | Industrial Hygienist |

I was responsible for heading field teams, while participating in environmental surveys of the Asbestos and Beryllium industries. On numerous occasions, I participated on a medical field team that was responsible for pulmonary function testing of Asbestos and Beryllium workers.

## Preventative Medicine - Ft. Leonard Wood

| Date | Agency | Job Title |
|---|---|---|
| September 1967 -<br>September 1969 | U.S. Army, Ft. Leonard Wood, Missouri<br>Preventive Medicine | Preventive Specialist<br>(Rank Sp-5) |

In this position, I maintained records of all admissions to the hospital for selected diseases, such as malaria, viral hepatitis, rheumatic fever, meningococcal disease, fever of unknown origin, and other communicable diseases. My duties included interviewing patients and making recommendations to the preventive medicine officer in relation to the patient and his environment. I was also in charge of the adenovirus surveillance program, recording all daily Upper Respiratory Infection (URI) admissions, and procuring (actual drawing of) paired sera and throat swabs on selected sections of the inpatient trainee population, in order to determine the dominant cause of URI's and thus indicate the type of adenovirus vaccine needed for control of the epidemic.

During my tour of duty, I was responsible for follow-up of unusual incidences of streptococcal sore throats, mass swabbing of units having a high incidence, and recommending prophylaxis when indicated. I helped to organize a rheumatic fever registry, which included close screening of all receptees and maintenance of a "suspense file" to indicate monthly prophylaxis. I was also involved in the diagnosis, treatment, and follow-up interviews of venereal disease cases. I reviewed (each morning) tine tests given to each new recruit, administered PPD's when indicated, and interviewed all positive reactors to determine if further tests should be made. I investigated food-borne disease outbreaks occurring on the Post. It was also my responsibility to help organize and conduct training programs for various units in good preventive medicine measures prior to deployment overseas.

## Missouri Division of Health

| Date | Agency | Job Title |
|---|---|---|
| January 1966 -<br>September 1967 | Missouri Division of Health | District Sanitarian |

My duties in this position entailed the inspection of food service establishments, milk processing plants, schools, motels, hotels, tourist camps, fairs, slaughterhouses, and rendering and beverage plants. I participated in field investigations and inspections of waste disposal operations, I determined if a health hazard existed, recommended corrective measures and interpreting the existing requirements set by Law. I assisted in the organization and operation of community sanitation programs in refuse disposal, insect and rodent control. I investigated complaints related to or connected with the public health and safety of individuals and society and recommended suitable corrective measures. Finally, I helped to organize and conduct courses for food service personnel in the sanitation field.

## COMMITTEE ASSIGNMENTS

1. NIOSH review Committee for the Hexavalent Chromium Criteria Document (alternate member) - 1973.
2. Program Advisory Committee (PAC) member for the Office of Occupational Health Surveillance and Biometrics.
3. Planning Committee - "National Conference on Health Effects of Occupational Lead and Arsenic Exposure," February 24-25, 1975, Chicago, Illinois.
4. Interagency Collaborative Group on Environmental Carcinogenesis - Alternate Member.
5. NIOSH Review Committee for the Nitrogen Dioxide Criteria Document - 1973.
6. NIOSH Agricultural Task [illegible]
7. NIOSH-NCI Cooperative Study of Former Asbestos Workers at Tyler, Texas.
8. Joint CEQ/HEW/EPA study on Environmental Carcinogenesis - Alternate NIOSH Representative.
9. PAC member on the Agricultural Program of NIOSH.
10. Board of Governors - Tri-State Air Committee. Ohio, Kentucky, and Indiana, 1973-1976 and 1979.
11. IARC Working Group on the Evaluation of Carcinogenic Risks of Chemicals To Man: Asbestos, Cadmium and Nickel. Lyon, France, December 9-11, 1975.
12. Appointed as the Key NIOSH staff person to develop the analysis paper on Asbestos to be transmitted to the Department of Labor for updating the Criteria for Occupational Exposure to Asbestos, 1976.

13. IARC Working Group on the Evaluation of Carcinogenic Risks of Chemicals in Man: Asbestos. Lyon, France, December 12-19, 1976, (authored the initial manuscript for the Working Group).

14. Conference Co-Chairman - Occupational and Environmental Exposure to Fibrous Materials and Particulate Matter, December 4-7, 1977, Washington D.C.

15. Veterans Administration Advisory Committee on Health-Related Effects of Herbicides, 1979.

16. Asbestos Hazards Safety Task Force, U.S. Department of Education personnel representative of the Secretary of Health and Human Services, 1980-1986.

17. Chairman - OSHA/NIOSH Task Force on Review of Occupational Exposure to Asbestos, September, 1979 - April, 1980, Washington, D.C.

18. IARC Working Group on the Evaluation of the Carcinogenic Risk of Exposures in the Rubber Industry, Lyon, France, June 16-23, 1981, co-rapporteur.

19. IARC Working Group on the Evaluation of Carcinogenic Risk of Chemicals to Humans: Miscellaneous Pesticides, Lyon, France, June 15-22, 1982.

20. Member - Federal Asbestos Task Force Steering Committee, U.S. Environmental Protection Agency, Department of Labor, Department of Labor, Department of Commerce, and Department of Health and Human Services, 1983-present.

21. Chairman - DHHS Committee on Health Effects of Ingested Asbestos, 1984-present.

22. Vice-Chairman, DHHS (PHS) Subcommittee on Environmental Health Risk Assessment, Committee to Coordinate Environmental Health Research, 1986-present.

23. Member (Alternate), National Cancer Advisory Board, 1987-present.

24. NIOSH Representative to the OSHA/NIOSH/EPA Committee to coordinate policy activities, 1980-present.

25. NIOSH Representative to the International Association of Industrial Accident Boards and Commissions, 1987 - Present.

26. NIOSH Member to the Task Force On Environmental Cancer and Heart and Lung Disease.

## CONGRESSIONAL TESTIMONY

1. Asbestos-Related Diseases; Committee on Education and Labor, Subcommittee on Labor Standards, United States House of Representatives, May 1, 1979, Washington, D.C.

2. Occupational Disease, including Occupational Cancers; Committee on Education and Labor, Subcommittee on Labor Standards, United States House of Representatives, 1979, Washington, D.C.

3. Asbestos Exposure Among Seamen and Shipyard Workers; Committee on Merchant Marine and Fisheries, Subcommittee on Coast Guard and Navigation, United States House of Representatives, February 12, 1980, Washington, D.C.

4. Potential Health Effects of Video Display Terminals and Radio Frequency Heaters and Sealers; Subcommittee on Investigations and Oversight, Committee on Science and Technology, United States House of Representatives, May 13, 1981, Washington, D.C.

5. Cotton Dust; Subcommittee on Investigations and Oversight, Committee on Science and Technology, United States House of Representatives, September 22, 1982, Washington, D.C.

6. Public Health Problem of Asbestos; Subcommittee on Manpower and Housing, Committee on Government Operations, United States House of Representatives, June 28, 1983, Washington, D.C.

7. Ethylene Dibromide; Committee on Education and Labor, Subcommittee on Labor Standards, United States House of Representatives, September 13, 1983, Washington, D.C.

8. Cabin Air Quality; Committee on Commerce, Science, and Transportation, Subcommittee on Aviation, United States Senate, November 9, 1983, Washington, D.C.

9. Asbestos; Subcommittee on Public Buildings and Grounds, Committee on Public Works and Transportation, United States House of Representatives, March 21, 1984, Washington, D.C.

10. Asbestos; Subcommittee on Public Buildings and Grounds, Committee on Public Works and Transportation, United States House of Representatives, October 2, 1984, Washington, D.C.

11. Methyl Isocyanate (MIC); Subcommittee on Health and Safety, Committee on Education and Labor, United States House of Representatives, December 12, 1984, Washington, D.C.

12. Hazardous Waste; Subcommittee on Employment and Housing, Committee on Government Operations, United States House of Representatives, March 27, 1985, Washington, D.C.

13. Neurotoxic Substances; Subcommittee on Investigations and Oversight, Committee on Science and Technology, United States House of Representatives, October 9, 1985, Washington, D.C.

14. Radiation Hazards: Subcommittee on Transportation and Hazardous Materials, Committee on Energy and Commerce, U.S. House of Representatives, U.S. Congress, Washington, D.C., February 23, 1989.

15. Diesel Exhaust: Subcommittee on Health and Safety, Committee on Education and Labor, U.S. House of Representatives, U.S. Congress, Washington, D.C., July 31, 1989.

## TESTIMONY TO DEPARTMENT OF LABOR

1. Occupational Exposure to Inorganic Arsenic: Risk Assessment; Washington, D.C., July 14, 1982.

2. Proposed Standard on Occupational Exposure to Cotton Dust; Washington, D.C., September 21, 1983.

3. Proposed Rule on Occupational Exposure to Ethylene Oxide; Washington, D.C., July 20, 1983.

4. Proposed Rule on Occupational Exposure to Field Sanitation; Washington, D.C., June 24, 1984.

5. Proposed Rule on Occupational Exposures in Grain Handling Facilities; Washington, D.C., May 14, 1984.

6. Proposed Rule on Occupational Exposure to Asbestos, Washington, D.C., June 21, 1984.

7. Proposed Rule on Occupational Exposures in the Oil and Gas Well Drilling and Servicing Industry, Washington, D.C., July 25, 1984.

8. Proposed Rule on Occupational Exposures to Ethylene Oxide, Washington, D.C., July 24, 1985.

9. Proposed Rule on Occupational Exposures to Benzene, Washington, D.C., March 20, 1986.

10. Proposed Rule on Occupational Exposures to Formaldehyde, Washington, D.C., May 5, 1986.

11. Proposed Rule on Hazardous Waste Operations and Emergency Response, Washington, D.C., October 4, 1987.

12. Proposed Rule on Safety Standards for Excavations in the Construction Industry, Washington, D.C., April 1, 1988.

13. Proposed Rule on Asbestos, Michigan State OSHA, East Lansing, Michigan, May 10, 1988.

14. Proposed Rule on Safety Standards for Excavations in the Construction Industry. 29 CFR 1926, Docket No. 5-204, OSHA Informal Hearing, Washington, D.C., April 19, 1988.

15. Proposed Rule on Air Contaminants, 29 CFR 1910, Docket No. H-020, OSHA Informal Hearing, Washington, D.C., August 1, 1988.

## SELECTED PAPERS PRESENTED

1. Health Hazards in the Aluminum and Chemical Industry--Third International Safety and Health Conference, Chicago, Illinois, United Steel Workers of America, September 25, 1973.

2. Asbestos-Related Disease: A Community Epidemic in the Making--American Public Health Association, Annual Meeting, San Francisco, California, November 4-8, 1973.

3. Peripheral Neuropathy Outbreak Among Coated Fabrics Workers--Epidemic Intelligence Surveillance Seminar, Atlanta, Georgia, CDC, December 4, 1973.

4. OSHA and the Nurse: OSHA and Pulmonary Disease--A Course for Nurses, Chicago, Illinois, March 16, 1974.

5. Field Studies Program of NIOSH--Missouri Environmental Health Association, Jefferson City, Missouri, August 7-9, 1974.

6. Cancer-Related Problems in the Metals Industry--National Safety Council Meeting, Chicago, Illinois, October 1, 1974.

7. Bio-Assay and Epidemiology--Tri-State Industrial Meeting, New Brunswick, New Jersey, American Industrial Hygiene Association, December 6, 1974.

8. Cytologic Observations and Cancer Incidence Following Exposure to BCME--New York Academy of Sciences, New York, New York, March 24-27, 1975.

9. Cytologic Operations and Cancer Incidence Following Exposure to BCME--American Public Health Association, Chicago, Illinois, November 17, 1983.

10. Co-Chairman-Health Aspects of Cadmium in the Environment--International Conference on Heavy Metals in the Environment, Toronto, Canada, October 27-31, 1975.

11. Cancer Mortality Among Workers Exposed to Cadmium--International Conference on Heavy Metals in the Environment, Toronto, Canada, October 27-31, 1975.

12. Evidence for the Carcinogenicity of Beryllium--International Conference on Heavy Metals in the Environment, Toronto, Canada, October 27-31, 1975.

13. Carcinogenicity of Alkylating Agents: Site, Incidence and Histology--American Public Health Association, Chicago, Illinois, November 16-20, 1975.

14. Problems in the Petrochemical Industry--Third International Symposium on Detection and Prevention of Cancer, New York, New York, April 26, 1976.

15. Peripheral Neuropathy Associated with Exposure to Solvents in a Coated Fabric Manufacturing Facility--American Occupational Medical Association 61st Annual Meeting, Cincinnati, Ohio, April 29, 1976.

16. Cancer-Related Problems in the Steel, Aluminum and Cadmium Smelting Industries--Environmental Cancer - Causes, Victims, Solutions: A Conference, Washington, D.C., Urban Environmental Conference, Inc., March 21-22.

17. Cancer-Related Problems in the Metals Industry: An Epidemiological Overview--Thirty-Second Meeting of the Interagency Collaborative Group on Environmental Carcinogenesis, Bethesda, Maryland, National Institutes of Health, May 18, 1977.

18. Evidence for Industrial Cadmium Carcinogenesis--American Industrial Hygiene Association, Chicago, Illinois, October 5, 1977.

19. Occupational Carcinogenesis--International conference on Cancer and Environment, Montreal, Quebec, Canada, October 13-14, 1977.

20. Overview of Industrial Carcinogens: Industrial and Environmental Carcinogens--The American Cancer Society-Massachusetts Division, Inc., and the U.S. Department of Labor, Occupational Safety and Health Administration, Boston, Massachusetts, October 19, 1977.

21. Carcinogens: Are They Responsible for 90 percent of our Cancer?--Trust Inc., Chicago, Illinois, January 19, 1978.

22. Epidemiology-Basic Principles and Terminology--Review Course in Preventive and Occupational Medicine, Chicago, Illinois, University of Illinois at the Medical Center, Office on Continuing Education Services, March 7, 1978.

23. Tyler, Texas - Revisited: A Review of Occupational and Environmental Exposures to Amosite Asbestos as a Result of Manufacturing Thermal Pipe Insulation--Department of Justice, Washington, D.C., May 1, 1979.

24. Epidemiology of Asbestos-Related Diseases--Biological Effects of Asbestos, Bethesda, Maryland, National Institutes of Health, June 7-8, 1979.

25. Occupational Diseases, including Occupational Cancers--Committee on Education and Labor, Subcommittee on Labor Standards, Washington, D.C., United States House of Representatives, June 7, 1979.

26. Impediments to Occupational Epidemiologic Studies--Conference on Epidemiologic Methods for Occupational and Environmental Health Studies, Society for Environmental Health, Washington, D.C., 1979.

27. Updated Occupational Mortality Study in the U.S. Cadmium Smelter--Second Annual Park City Environmental Health Conference, Health and Exposures in the Smelter Environment, Park City, Utah, March 27, 1980.

28. NIOSH's relationship to OSHA's New Direction Grants Program--Department of Labor, OSHA's New Directions Grantees Conference, Washington, D.C., December 17, 1980.

29. NIOSH's Standards Recommending Program--presented at the Third Annual Park City Environmental Health Conference, Park City, Utah, April 7, 1981.

30. Priority Setting and Quantitative Risk Assessment--Committee on the Institutional Means for Assessment of Risks to Public Health, Washington, D.C., The National Research Council, Assembly of Life Sciences, October 13, 1981.

31. Identification of Occupational Health Hazards: The Past--Conference on Occupational Health Hazards (Carcinogens in Particular), Royal Botanical Gardens, Burlington, Ontario, Canada, McMaster University, November 10, 1981.

32. Impediments to Occupational Epidemiologic Studies--Columbia University School of Public Health, New York, New York, February 25, 1982.

33. Asbestos and Disease--Ohio River Valley Conference on Occupational Safety and Health, Cincinnati, Ohio, March 6, 1982.

34. NIOSH's Current Approach to Criteria Document Development--Chemical Manufacturers Association, Arlington, Virginia, April 29, 1982.

35. Overview of Cancer in the Workplace--Symposium on Recognition and Prevention of Cancer Among Workers for Rubber Workers and Their Management, Akron, Ohio, August 17, 1983.

36. Epidemiology: Picking out Health Patterns and Relating Them to the Workplace--Occupational Safety and Health Institute, Silver Springs, Maryland, George Meany Center for Labor Studies, May 24, 1983.

37. Scientific Bases for Public Health Action in Communities and Workplaces with Potential Dioxin Exposure--Society for Occupational and Environmental Health Program on the Scientific and Social Response From Exposure to Dioxin and Related Materials, Arlington, Virginia, December 6-7, 1983.

38. Occupational Epidemiology, Occupational Safety and Health Institute--George Meany Center for Labor Studies, May 1983 and June 12, 1984, Washington, D.C.

39. Workers Right-to-Know--University of South Florida, College of Medicine, Tampa, Florida, March 16, 1984.

40. Risk Management--Dubos Forum on Environment and Human Health, The Rockefeller University, New York, New York, September 20, 1984.

41. The Role of NIOSH - Standards Development for Occupational Safety and Health--National Safety Congress, October 17, 1984.

42. The Health and Safety Hazards of Building Ships--3rd Biennial National Shipbuilding conference, Metal Trades Department, AFL-CIO, Washington, D.C., November 15, 1984.

43. NIOSH and Chemical Hazards in the Workplace--The Synthetic Organic Chemical Manufacturers' Association, Inc., Charlotte, N.C., March 18, 1985.

44. Asbestos and Cancer--The American Society for Preventative Oncology, Toronto, Canada, April 12, 1985.

45. Overview of the Federal Role in Occupational Safety and Health, Chicago Area Committee on Occupational Safety and Health, Chicago, Illinois, April 27, 1985.

46. Top 10 Leading Occupational Safety and Health Problems--Chinese Medical Association, Washington, D.C., April 28, 1985.

47. New Directions in Occupational Health: Epidemiologic Perspectives--Symposium on Epidemiology and Clinical Trials, Taipei, Republic of China, June 11, 1985.

48. Cancer Policy-NIOSH--Northeast Industrial Hygiene Conference, Cherry Hill, Pennsylvania, December 6, 1985.

49. Current Knowledge of Health Effects of Asbestos--Northwest Center for Occupational Health and Safety, University of Washington, Seattle, Washington, March 11, 1986.

50. Luncheon Speaker--Conference on Environment, Health, and Safety, Rubber Manufacturers Association, Atlanta, Georgia, April 27, 1986.

51. Risks Old and New: A Global Consultation on Health, Occupational and Environmental Health Overview, Responder--The Carter Center, Emory University, Atlanta, Georgia, April 28, 1986.

52. A Proposed National Strategy for the Prevention of Occupational Cancers, Chairman, Expert Panel--1st National Symposium on the Prevention of Work-Related Diseases and Injuries, Atlanta, Georgia, May 1-3, 1985.

53. An Update of Asbestos Effects and Regulation--14th Annual Air Pollution/Contamination Control Seminar, Rosnagel and Associates, King of Prussia, Pennsylvania, May 22, 1986.

54. Formaldehyde, Benzene, and Standards Setting--Grand Rounds, Medical School, University of Illinois, Chicago, Illinois, June 12, 1986.

55. Asbestos and Merchant Seamen in the U.S.--Collegium Ramazzini, Heidelberg, Germany, July 8, 1986.

56. A Proposed National Strategy for the Prevention of Disorders of Reproduction, Chairman, Expert Panel--2nd National Symposium for the Prevention of Leading Work-Related Diseases and Injuries, Cincinnati, Ohio, October 28-31, 1986.

57. Occupational Safety and Health Standards: A Perspective, New York Academy of Sciences Meeting, Washington, D.C., January 22, 1988.

58. What is Asbestos: 17th Annual Meeting - Society of Mining Engineers, Phoenix, Arizona, January 25, 1988.

59. Priority Setting and Criteria Work, National Institute of Occupational Health, Stockholm, Sweden, February 22, 1988.

60. Man-Made Mineral Fibers: A Regulatory Perspective, Northwest Center for Occupational Health and Safety, Seattle, Washington, May 5, 1988.

61. Occupational Safety and Health Standards: A Perspective. 1988 Joint Labor/Management Health and Safety Symposium, United Rubber Workers, Bal Harbour, Florida, September 20, 1988.

62. Occupational Safety and Health - The NIOSH Perspective. Missouri Public Health Association, Lake of the Ozarks, Missouri, April 6, 1989.

63. NIOSH. Organizations Resources Councilers. Arlington, Va., May 3, 1989.

64. Asbestos Related Diseases. Fifth Annual Asbestos Litigation Seminar. Monterey, California, May 12, 1989.

65. Prevention of Human Exposures and Health Effects from Crude Oil. The Alaskan Oil Spill and Human Health, Chairperson. Seattle, Washington, July 30, 1989.

66. NIOSH - LIUNA Cooperation. Laborers - Association of General Contractors Education and Training Fund, 20th Anniversary Conference, Boston, Massachusetts, July 26, 1989.

67. NIOSH Perspectives on the Ecology of Human Populations in Estuarine Environments. Workshop on Opportunities for Human and Environmental Health Research on Estuarine Environments, Workplace Health Fund. Solomons, Md., August 31, 1989.

68. Global Warming, Energy Conservation and Thermal Insulation. Chairperson, First Annual Environmental Conference Week, Associated Programs, Workplace Health Fund. Solomons, Md., August 28, 1989.

69. Efecto Medicos/Vigilancia Medica. Seminario Sobre Asbesto. San Juan and Ponce, Peurto Rico, September 11 and 13, 1989.

70. Man-Made Mineral Fibers: A Regulatory Perspective. National Safety Congress and Exposition, Chicago, Il., October 31, 1989.

## SELECTED PUBLICATIONS, MONOGRAPHS, AND BOOKS

1. Varela, G, Lemen, RA: Summer Health Hazards. Office of the Post Surgeon, U.S. Army, Fort Leonard Wood, MO, 1968.

2. Donnel, HD, Jr., Ward, MJ, Lemen, RA: Data for Health Planning Purposes. Program Methodology Unit, Missouri Regional Medical Program, Columbia, MO, pp. 73, 1970.

3. Wagoner, JK, Johnson, WM, Lemen, RA: Malignant and Non-Malignant Respiratory Disease Patterns Among Asbestos Production Workers. Congressional Record - Senate pp. 7828-7830, 1973.

4. Fontaine, RE, Lemen, RA, Heath, CW: Peripheral Neuropathy. An unpublished report to the Director, Center for Disease Control, Public Health Service, Atlanta, Georgia, EP1-74-29-2 (distribution limited), pp. 15, 1974.

5. Lemen, RA, Johnson, WM, Wagoner, JK, Archer, VE, Saccomanno, G: Cytologic Observations and Cancer Incidence following Exposure to BCME. Occupational Carcinogenesis, Annals of the New York Academy of Sciences, Eds., Umberto Saffiotti and Joseph K. Wagoner, 271:71-80, 1976.

6. Lemen, RA, Wagoner, JK, Blejer, HP: Mortality Among Workers Exposed to Cadmium. Occupational Carcinogenesis, Annals of the New York Academy of Sciences, Eds., Umberto Saffiotti and Joseph K. Wagoner, 271:273-279, 1976.

7. Gillam, JD, Dement, J, Lemen, RA, Wagoner, JK, Blejer, HP: Mortality Patterns Among Hard Rock Gold Miners Exposed to an Asbestiform Mineral. .Occupational Carcinogenesis, Annals of New York Academy of Sciences, Eds., Umberto Saffiotti and Joseph K. Wagoner, 271:336-344, 1976.

8. Bridbord, K, Wagoner, JK, Blejer, HP, Landrigan, PJ, Lemen, RA: The Role of Epidemiology in Assessing the Health Effects of Metals. International Conference on Environmental Sensing and Assessment, 1:1-4, 1976.

9 Lloyd, JW, Lemen, RA: Cancer hazards in Steel, Ferroalloy and Aluminum Production. Proceedings of the International Conference on Health in Metal Working Industries, Oslo, Norway, August 16-19, 1976.

10. Infante, PF, Lemen, RA: Asbestos in Dentistry. American Dental Association Journal, 93:221-222, 1976.

11. Lemen, RA, Brown, DP, Rinsky, RA, Young, RJ, Meinhardt, TJ: Health Problems Associated with Selected Petrochemicals: Benzene, Chlorinated Hydrocarbons, and Styrene-Butadiene Rubber. Prevention and Detection of Cancer, Macel Dekker, Inc., New York and Basel, Library of Congress Catalog Card Number 77-87546. Ed., H. E., Nieburgs, 1879-1891, 1978.

12. Lemen, RA, et al.,: Comments on Critique of "Mortality Patterns Among Hard Rock Gold Miners Exposed to an Asbestiform Mineral" and "Asbestos Fiber Exposures in a Hard Rock Gold Mine." National Technical Information Service, Springfield, Virginia, 1977.

13. Lemen, RA, Dement, JM, Wagoner, JK: Reevaluation of Data Relative to Health Effects of Occupational Exposure to Asbestos. U.S. Department of Health, Education and Welfare, Public Health Service, Center for Disease Control, National Institute for Occupational Safety and Health (NIOSH), DHEW Publication No. 77-169, 1977.

14. IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Man--Asbestos. Draft Prepared by RA, Lemen, International Agency for Research on Cancer, World Health Organization, Lyon, France, Vol. 14, 1977.

15. Lemen, RA: Cancer Related Problems in the Steel, Aluminum and Cadmium Smelting Industries. Proceedings of a Conference on Environmental Cancer Causes, Victims, and Solutions; Urban Environment Conference, Inc., 1977.

16. Lemen, RA, Young, R: Investigations of Health Hazards in Styrene-Butadiene Rubber Facilities. Proceedings of NIOSH Styrene-Butadiene Briefing, April 30, 1976, DHEW Publication No. (NIOSH) 77-129, U.S. Department of Health, Education and Welfare, Public Health Service, CDC, NIOSH, Cincinnati, Ohio, December 1976, pp. 3-8, 1977.

17. Lemen, RA: Epidemiologic Studies. Proceedings of NIOSH Styrene-Butadiene Briefing, April 30, 1976. DHEW Publication No. (NIOSH) 77-129, U.S. Department of Health, Education and Welfare, CDC, NIOSH, Cincinnati, Ohio, December 1976, pp. 49-50, 1977.

18. Lemen, RA, Epstein, SS: Environmental Pollution and Carcinogenic Risks, Book Review. The Science of Total Environment, Elsevier Scientific Publishing Company, Amsterdam-Printed in the Netherlands, p. 355, 1977.

19. Lemen, RA, Dement, JM: Dust and Disease. Pathotox Publishers, Inc., Park Forest South, Illinois, Library of Congress Catalog Card Number 79-88819, 1979.

20. Robinson, C, Lemen, RA, Wagoner, JK: Mortality Patterns, 1940-1975, Among Workers Employed in an Asbestos Textile Friction and Packing Products Manufacturing Facility. In. Dust and Disease, Eds., Lemen, RA and Dement, JM, Pathotox Publishers, Inc., Chicago, Illinois, 1979.

21. Lemen, RA, Dement, JM, Wagoner, JK: Epidemiology of Asbestos-Related Diseases. Environmental Health Perspectives, 34:1-11, 1979, February, 1980.

22. Lemen, RA, et al.: Workplace Exposure to Asbestos: Review and Recommendations. NIOSH/OSHA Asbestos Work Group, U.S. Department Health Education and Welfare and the U.S. Department of Labor, DHHS (NIOSH) Publication No. 81-103, April, 1980.

23. Stern, FB, Lemen, RA: Mortality Study Among Motor Vehicle Examiners Exposed to Automotive Exhaust. Arch. Env. Health, March/April, 36:2:59-66, 1981.

24. McCammon, CS, Halperin, WF, Lemen, RA: Carbon Monoxide Exposure from Aircraft Refueling Vehicles. Arch. Env. Health, May/June, 36:3:136-138, 1981.

25. Martin, WF, Lemen, RA: NIOSH's Standards Recommending Program. Proceedings of the Third Annual Park City Environmental Health Conference. Ed. William Rour and Jefferey S. Lee. Legal and Ethical Dilemmas in Occupational Health, Ann Arbor Science, 1982.

26. Johnson, WM, Lemen, RA, Hurst, GA, Spiegel, RM, Liu, FHY: Respiratory Morbidity Among Workers in An Amosite Asbestos Insulation Plant. Journal of Occupational Medicine, 24:12, December, 1982.

27. Ing, R, Falk, H, Lemen, RA, Carson, G, Kelter, A, Srn, J, Gray, M: Community Asbestos Exposure in Globe Arizona. The Journal of Pediatrics, 99:3, September, 1981, The C.V. Mosby Co.

28. Landrigan, PJ, Meinhardt, TJ, Gordon, J, Lipscomb, JA, Gurg, JR, Mazzuckelli, LF, Lewis, TR, Lemen, RA: Ethylene Oxide: An Overview of Toxicologic And Epidemiologic Research. American Journal of Industrial Medicine 6:103-115, 1984.

29. Stayner, LT, Meinhardt, TJ, Lemen, RA, Bayliss, D, Herrick, R, Reeve, GR, Smith, AB, Halperin, W: A Retrospective Cohort Mortality Study of a Phosphate Fertilizer Production Facility. Archives of Environmental Health 40(3):133, 1983.

30. Waxeiler, RJ, Beaumont, JJ, Henry, JA, Brown, DP, Robinson, CF, Ness, GO, Wagoner, JK, Lemen, RA: A Modified Life-Table Analysis System for Cohort Studies, Journal of Occupational Medicine, 25:2, February, 1983.

31. Meinhardt, TJ, Lemen, RA, Crandall, MS, Young, RJ: Environmental Epidemiologic Investigation of the Styrene-butadiene Rubber Industry, Scand J Work Environ Health, 8:4, December, 1982.

32. Lemen, RA: Occupational Induced Lung Cancer. Occupational Respiratory Disease, J. M. Merchant, Ed., U.S. Department of Health and Human Services, NIOSH, DHHS(NIOSH), Publication No. 86-102, September, 1986.

33. Lemen, RA: Health Hazards in Shipbuilding. Proceedings of the 3rd Biennial National Shipbuilding Conference, Metal Trades Department, AFL-CIO, Washington, D.C., 1985.

34. Lemen, RA, Dunnom, DD, Wagner, WD, Mazzuckelli, LF: Recommended Standards for Occupational Exposure to Silica. In: Silica, Silicosis, and Cancer, Ed. Goldsmith, DF, Winn, DM, Shy, CM, Praeger, Cancer Research Monographs 2:505, 1986.

35. Lemen, RA, Meinhardt, TJ, Becking, G, Cantor, K, Cherner, J, Cordle, F, Groth, D, Keller, C, Lybarger, J, McConnell, E, Millette, J, Patel, Y, Mullin, C, Tollefson, L: Report on Cancer Risks Associated with Ingestion of Asbestos, Environmental Health Perspectives, Vol. 71, March 1987.

36. Schoenborn, TF, Newman, J, Lemen, RA: Information Sources for Occupational Safety and Health, Chapter 11. Handbook on Occupational Safety and Health, Ed., Lawrence Slote, John Wiley & Sons, New York, pp.247-363, 1987.

37. Lemen, RA, Meinhardt, TJ, Crandall, MS, Fajen, JM, Brown, DP, Environmental Epidemiological Investigations of the Styrene-Butadiene Rubber Industry. Accepted by Environmental Health Perspectives, In Press.

38. Lemen RA, Mazzuckelli, LF, Neimeier, R, Ahlers, HA: Occupational Safety and Health Standards: A Perspective, Annals of the New York Academy of Sciences, In Press.

39. Robinson, CF, Fowler, D, Brown, DP, Lemen, RA: Plywood Mill Workers' Mortality 1944-1977. Accepted By Scand J Work Env Health, In Press.

## SHORT-TERM EDUCATIONAL TRAINING

1. Epidemiology and Control of Food-Borne Disease: January 24-28, 1966, at the Communicable Disease Center, U.S. Public Health Service at Jefferson City, Missouri.

2. Field Training Course in Environmental Sanitation: June 23-August 5, 1966, at the University of Missouri, by the U.S. Public Health Service.

3. Rodent-Borne Disease Control: July, 1966, at the Communicable Disease Center, U.S. Public Health Service, at Columbia, Missouri.

4. Mosquito-Borne Disease: May 31-June 9, 1967, at the Communicable Disease Center, U.S. Public Health Service, Atlanta, Georgia.

5. Air Sampling in the Occupational Environment: September-October, 1970, Training Institute, Environmental Control Administration, U.S. Public Health Service at Cincinnati, Ohio.

6. Industrial Hygiene Engineering (501): November 30-December 11, 1970, Training Institute, Environmental Control Administration, U.S. Public Health Service, Cincinnati, Ohio.

7. DOS-COBOL Seminar: October 26-30, 1970, Cincinnati, Ohio.

8. Twentieth Industrial Ventilation Conference: February 14-19, 1971, Continuing Education Program, Michigan State University, Lansing, Michigan.

9. Principles of Chemical Epidemiology: October 19-22, 1971, Environmental Protection Agency, Atlanta, Georgia.

## ORGANIZATION MEMBERSHIPS

1. Society for Occupational and Environmental Health, Board of Directors, 1980-1982.
2. Board of Governors, Tri-State Air Committee, 1973-1976 and 1979, Cincinnati, Ohio.
3. Beta Beta Beta - Honorary Society for Biological Science.
4. The Professional Association of the Commissioned Corps of the United States Public Health Service.
5. Association of Military Surgeons of the United States.
6. The Retired Officers Association of the United States.

## AWARDS AND SERVICE RIBBONS

1. Army Commendation Medal for Meritorious Service, November 1967-August 1969.
2. National Defense Service Medal, U.S. Army, 1969.
3. Good Conduct Medal, United States Army, 1967-1969.
4. National Defense Ribbon, 1967-1969.
5. U.S. Public Health Service Commendation Medal for Work Related to Occupational Diseases Associated with Asbestos Exposure, 1970-1981.
6. Special Assignment Service Ribbon, USPHS.
7. Foreign Duty Service Ribbon, USPHS.
8. Hazardous Duty Service Ribbon, USPHS.
9. Who's Who in America, 1984-1985, 43rd Edition, Vol. 2.
10. Who's Who in America, 1986-1987, 44th Edition, Vol. 2.
11. U.S. Public Health Service Commendation Medal, 1985, second award.
12. Who's Who in America, 1988-1989, 45th Edition, Vol. 2.
13. U.S. Public Health Service Meriterious Service Medal, 1988.
14. Distinguished Alumni, Central Methodist College, April 1989.
15. Who's Who in America, 46th Edition, Vol. 2.

## FOREIGN TRIPS AS REPRESENTATIVE OF DHHS

1. Attended the VIII International Congress on Occupational Health, Brighton, England, September 14-19, 1975, as a NIOSH representative.

2. Tutored at the workshop and training course on Cancer Registries and Occupational Cancer, sponsored by the International Agency for Research on Cancer in Lyon, France, September 22-26, 1975.

3. Visited as an official guest of Der Staatliche Gewerbearzt in Dusseldorf, Germany, September 27-October 4, 1975.

4. Temporary Advisor to IARC Working Group on the Evaluation of Carcinogenic Risks of Chemicals to Man: Asbestos, Cadmium and Nickel. Lyon, France, December 9-11, 1975.

5. Consulted with Dr. J. C. Wagner of the National Research Council on Health Hazards Associated with Asbestos, Cardiff, Wales, England, September 6-10, 1976.

6. IARC Working Group on the Evaluation of Carcinogenic Risks of Chemicals to Man: Asbestos. Lyon, France, December 12-19, 1976. (Authored the initial manuscript.)

7. Visited with Swedish Occupational Safety and Health Researchers and Labor Representatives, Stockholm, Sweden, April, 1980.

8. Member of the International Agency for Research on Cancer Working Group on the Evaluation of the Carcinogenic Risk of Exposures in the Rubber Industry, Lyon, France, June 16-23, 1981.

9. Testimony before the Royal Commission on Matters of Health and Safety Arising from the Use of Asbestos in Ontario, Toronto, Canada, July 8, 1981.

10. Member of the International Agency for Research on Cancer Working Group on the Evaluation of the Carcinogenic Risk of Chemicals to Humans: Miscellaneous Pesticides, Lyon, France, June 15-22.

11. NIOSH/WHO Cooperative Agreement Discussions, Geneva, Switzerland, September, 1983.

12. Environmental Survey and Evaluation of Refugee Processing Centres in Bataan Peninsula, The Philippines and Phanat Nikhom, Chonburi Province, Thailand, February 8-16, 1984.

13. Negotiated NIOSH/WHO Cooperative Agreement Discussions, Geneva, Switzerland, August 13-19, 1984.

14. Official Guest, Academia Sinica and Department of Health, Republic of China, June 2-14, 1985.

15. Collegium Ramazzini, Heidelberg, Germany, July 4-8, 1986.

16. Programe Advisory Committee, Occupational Health Program, WHO, Geneva, Switzerland, February 13-19, 1988.

17. National Institute of Occupational Health, Stockholm, Sweden, February 20-24, 1988.

18. Collegium Ramazzini, Pneumoconiosis Conference and Merchant Seamen Conference, Athens, Greece, May 17-21, 1988.

19. Conference on the Disease Potential of Different Asbestos Fiber Varities. Ottawa, Canada, March 20-22, 1989.

# Statement

by

J. Bernard L. Gee, M.Sc., M.D., FCCP, FRCP, FFOM
Professor of Medicine
Yale University School of Medicine
Director, Winchester Chest Clinic
Yale New Haven Hospital
New Haven, CT 06510

Before

Committee on Environment and Public Works
Subcommittee on Toxic Substances,
Environmental Oversight, Research and Development
U.S. Senate
Washington, D.C. 20510

April 26, 1990

Mr. Chairman and Members of the Committee:

Thank you for the invitation to testify today. My name is Bernard Gee. I am a Professor of Medicine at Yale. In 1971 I editorially supported the lowering of the OSHA asbestos standard (1). I once testified for workers involved in asbestos removal. In the last 2 years, having reviewed many medical records, I subsequently testified in court on six occasions at the request of counsel for asbestos manufacturers.

I am a co-author of two reviews (2,3), one by an international interdisciplinary group, on asbestos and health matters.

## Background

Asbestos in the workplace has unquestionably been a very serious cause of morbidity and premature deaths from insidious lung fibrosis and malignant respiratory disease for certain workers, and sometimes for their families. In the face of such tragic consequences, asbestos acquired a fearsome reputation.

The purpose of my testimony is not to deny the past but to address the present situation of asbestos in buildings including schools.

## Types of Asbestos

Asbestos is a commercial term for a group of fibrous minerals which differ mineralogically and in their biologic effects. Two types are important, curly chrysotile and rod/needle amphiboles. After lung deposition (an essential prerequisite) both can cause asbestosis but differ in carcinogenic capabilities, which also depend on fiber dimensions. Historically work place airborne fiber levels were high -- commonly 100 f/cc. The OSHA asbestos standard is now 0.2 f/cc. In further sharp contrast, airborne fiber levels of biologically critical dimensions in buildings, schools and outside air are _all_ less than 0.001 f/cc (100 times less than the OSHA standard).

_Asbestos Related Disorders and Fiber Levels_

_Asbestosis_ -- lung fibrosis -- is now far less prevalent in the work place since the imposition of the OSHA 0.2 f/cc standard which was designed to _prevent_ this disorder. Thus at present building air exposures of 0.001 (or less) f/cc, asbestosis should not occur even with a life time exposure.

_Lung Cancer_. Lung cancers occur infrequently among non-smokers. Cigarette smoking can cause a fifty fold increase in lung cancers (4). Historically, few asbestos workers were non-smokers, less than 30 lung cancers being reported in non-smoking workers. For instance, in one large worker cohort, of 471 persons with lung cancers only four were non-smokers! Whatever one's opinions on the inter-relationship between smoking and asbestos as causes of lung cancer, smoking cessation will drastically diminish such deaths. This "voluntary" risk of smoking is quantitatively the real concern not the "involuntary" risk of building asbestos exposure. Further and most importantly, the _in_voluntary lung cancer risk from present asbestos building levels is tiny as deduced from recent, smoking adjusted, epidemiologic studies of workers exposed to low fiber counts. Further, for the general population, there is evidence from lung asbestos fiber burden measurements that asbestos plays _no_ role in societal lung cancer.

_Mesothelioma._ Of these fortunately very rare but fatal cancers of the lung lining membrane, some 20-30% have no known cause, tobacco being unrelated. In North America the remainder are due to "asbestos". They occur decades after first exposure, so legitimately raising concern about schoolchildren with their long life expectancy. However, they require large exposures sufficient to leave large numbers of fibers in the autopsied lungs of these unfortunate persons.

In our opinion, amphiboles (most importantly crocidolite) of certain fiber dimensions are the culprits. Epidemiologic evidence from many countries strongly suggests that chrysotile (particularly in the absence of the 1% tremolite contamination in some mines) causes few mesotheliomata. Less than 60 have occurred over decades in association with the large chrysotile mines of Quebec Province. Since, _first_ chrysotile constitutes at least 90% of North American building asbestos and _second_ airborne fiber levels of the critical dimensions are so low, the mesothelioma risk is minuscule. Indeed, less than 1% of all mesotheliomata would result from asbestos in schools (5).

## Conclusion

We submit the risks are not for Society in general but for asbestos abatement workers who will have to perform the very job the insulators have come to fear most -- asbestos rip-out.

Mr. Chairman, I suggest it is essential to act quickly at the very least to temporarily abate (!) the effects of present laws since many schools such as the one in New Canaan, CT are subject to immediate legal constraints which will drain the municipal pockets for little or no reason. We agree with the Editorial reprinted from the New Canaan Advertiser: "It is the law then, in all of its environmental zeal, that is flawed" (6).

## References

1. Gee JBL, Bouhuys A: Action on asbestos. N Engl J Med 285:1317, 1971

2. Mossman BT, Gee JBL: Medical progress. Asbestos-related diseases. N Engl J Med 320:1721, 1989

3. Mossman BT, Bignon J, Corn M, Seaton A, Gee JBL: Asbestos: Scientific developments and implications for public policy. Science 247:294, 1990

## Supporting Data in Appendix

4. Wynder E: The epidemiology of cancer of the respiratory tract. In The Prevention and Detection of Cancer. Nyburg (ed). Marcel Dekker, New York, 1980

5. Weill H, Hughes JM (reference 2, Table 2)

6. Editorial, New Canaan (CT) Advertiser, 03/15/90

# Appendix to Statement

by

J. Bernard L. Gee, M.Sc., M.D., FCCP, FRCP, FFOM

# Asbestos Exposure, Smoking and Lung Cancer -- Results of a Cohort Study in the Asbestos Cement Industry

M. NEUBERGER, M. KUNDI, H.P. FRIEDL, M. HAIDER. Institute of Environmental Hygiene, University, Vienna, Austria

In the oldest asbestos cement factory a historical prospective cohort study set up in the 1970s included all persons employed in 1950-1981 and for at least 3 years. From 2816 persons eligible for the study record-based estimates and measurements of dust and fibers and inteview-based smoking histories were used to calculate person-related exposures over time. After observation of 51218 person years and registration of 540 deaths underlying causes were compared with the regional population on the basis of death certificates (autopsy rate 30%).

Lung cancer in asbestos cement workers was raised (SMR 172), but not significantly after adjustment for age- and sex-specific smoking habits (SMR 104). Using the best available evidence (including autopsy records ) 52 deaths were assigned to lung cancer and 5 to mesothelioma. Their cumulated dose-distribution differed from cases not associated with asbestos, for exposures >50 fibers/ml.years. Life table analyses confirmed the predominant influence of smoking on lung cancer. Mesothelioma was associated with the use of crocydolite in pipe production. A relative lung cancer risk of >1,3 can be ruled out in the given dose-range with predominant use of chrysotile.

Abstract: VIIth International Pneumoconioses Conference, August 23-26, 1988, Pittsburgh, PA

Doll and Peto have emphasized the importance of exposure and response: "For it is still widely believed in spite of consistent evidence to the contrary that very brief exposure necessarily causes a substantial risk of mesothelioma. Cases have occasionally been caused by short very intense exposure to amphiboles, but under most circumstances the risk caused by very brief exposure is negligible." (Doll R, Peto J: Effects on health of Exposure to Asbestos. London, Health and Safety Commission, Her Majesty's Stationery Office, 1985)

"There is the difference between the effects of chrysotile and amphiboles, which is so great in relation to mesothelioma that it is possible to argue that chrysotile does not cause mesothelioma at all and that the relatively few cases that have occurred in men occupationally exposed to chrysotile have been due to the presence of an unintended contamination with minute amounts of tremolite."

"That pure chrysotile does not cause mesothelioma is strongly suggested by the low incidence of the disease in groups of men and women occupationally exposed only to chrysotile (with or without some contamination by tremolite) and by the results of tissue analyses which have repeatedly shown that the lungs of people who have died of mesothelioma contain very little (if any) more chrysotile than the lungs of those who have died on non-asbestos-related diseases, once the amount of any associated amphibole is taken into account." (Doll R: Mineral Fibres in the Non-occupational Environment: Concluding Remarks. In Non-Occupational Exposure to Mineral Fibres. J Bignon, J Peto, R Saracci (eds). Lyon, IARC Scientific Publications, 1989)

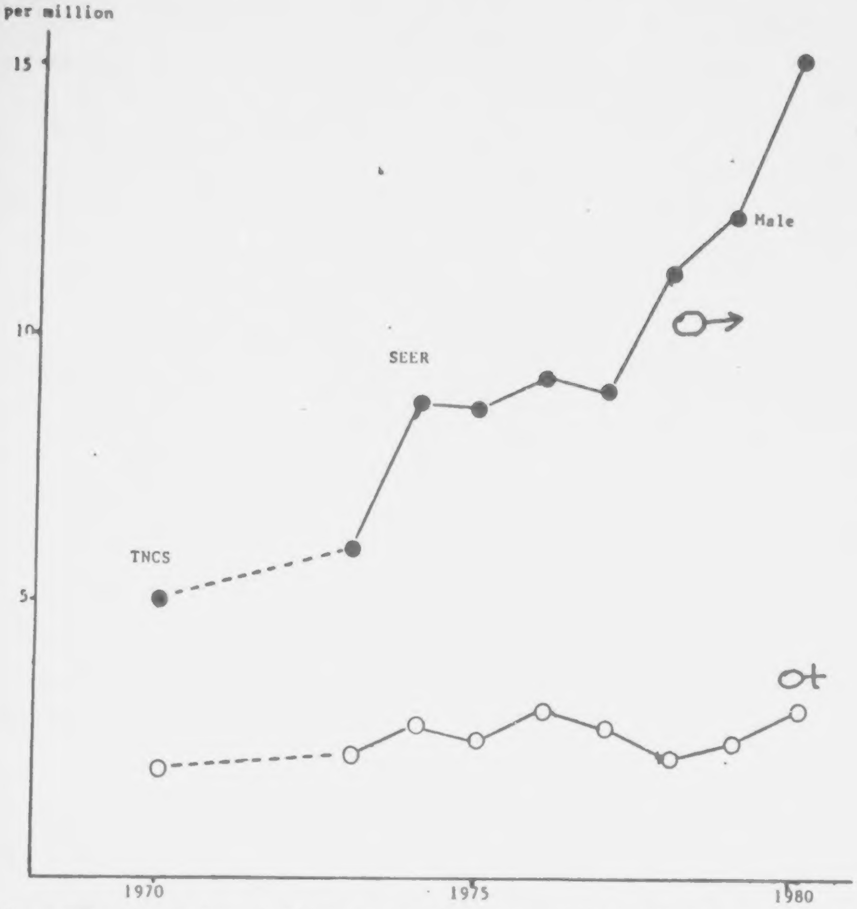


**Figure 2-2.** Mesothelioma incidence in the United States, 1970–80, age adjusted to the national population. The data for 1973–80 are for all sites and all races from the nine areas participating in the SEER program. The rates for 1970 are from the Third National Cancer Survey. With permission from McDonald, Environ Health Perspect 62:319–328. 1986.

## MALIGNANT MESOTHELIOMA IN MALE OCCUPATIONAL COHORTS

| Mining & manufacturing | Total deaths | Meso's deaths | Per cent |
|---|---|---|---|
| Chrysotile | 5062 | 10 | 0.2 |
| Crocidolite | 569 | 33 | 5.8 |
| Chrysotile & Amphibole | | | |
| Low Amphibole | 4797 | 37 | 0.8 |
| High Amphibole | 926 | 77 | 3.3 |
| **Insulation & Shipyards** | | | |
| Chrysotile & Amphibole | 3654 | 266 | 7.3 |

Adapted from McDonald AD, McDonald JC: Epidemiology of malignant meosthelioma. In Asbestos-Related Malignancy, Antman K, Aisner J (eds). Grune & Stratton, Inc., Orlando, FL, 1987 (Table 2-3)

Table 2-4

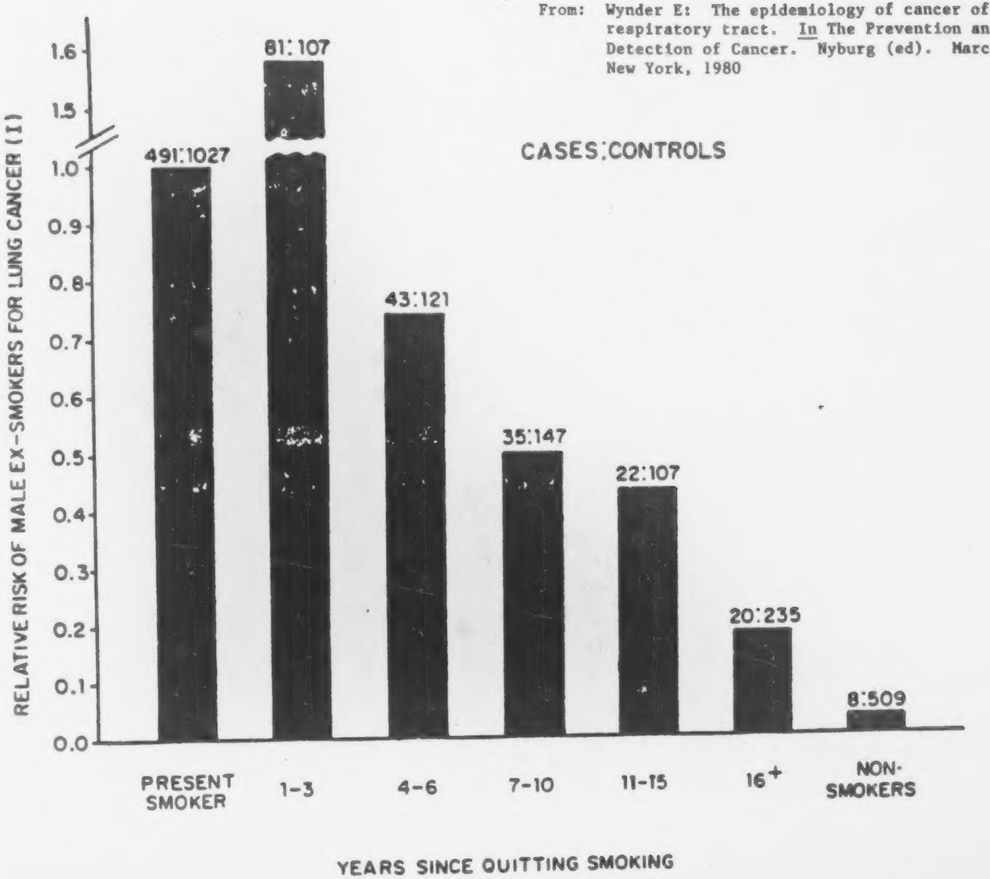
Mesothelioma in 11 Female Cohorts*

| | Chrysotile only[3] | Amphibole only[2] | Mixtures[6] |
|---|---|---|---|
| Deaths | 414 | 179 | 1049 |
| Lung cancer excess | 5.1 (1.2%) | 8.2 (4.6%) | 46.7 (4.5%) |
| Mesothelioma | 1 (0.21%) | 19 (10.6%) | 38 (3.6%) |

*See Table 3-3.

From McDonald AD, McDonald JC: Epidemiology of malignant mesothelioma. In Asbestos-Related Malignancy, Antman K, Aisner J (eds). Grune & Stratton, Inc., Orlando, Florida 1987.

From: Wynder E: The epidemiology of cancer of the respiratory tract. In The Prevention and Detection of Cancer. Nyburg (ed). Marcel Dekker, New York, 1980



Yale University

J. Bernard L. Gee, M.D.
Pulmonary and Critical Care Section
Department of Internal Medicine
School of Medicine
5038 LMP
P.O. Box 3333
New Haven, Connecticut 06510-8057

Campus Address:
5038 LMP
333 Cedar Street
Telephone:
203 785-4195

May 1, 1990

Members, Subcommittee on Toxic Substances,
Environmental Oversight, Research and Development
Committee on Environment and Public Works
United States Senate
Washington, D.C. 20510

Gentlemen:

Thank you for the courtesy shown to me on the occasion of my testimony before the Subcommittee on Toxic Substances, Environmental Oversight, Research and Development on April 26, 1990.

I have reflected on the several testimonies and the correspondence which will appear in Science. There are several ways in which the testimony indicates that we are not always listening to one another. Perhaps the real confusion centers around a failure to separate the asbestos related disorders. For instance:

(1) Lay testimony clearly lumps all asbestos related disorders together -- asbestosis, lung cancer and mesothelioma. The first is simply not a societal (non-occupational) problem. The role of smoking in lung cancer is quantitatively inapparent to the school representatives. Some educators may need re-education!

(2) Scientific testimony by some persons focused on the similarity of the asbestos types and assumes we (Science group) think there to be major differences in pathogenicity for all asbestos related disorders. While we do consider there are small differences in amphiboles versus chrysotile as causes of fibrosis (asbestosis) and lung cancer, we did not nor do we regard this as the crucial distinction for these disorders. We fully recognize textile manufacturing (chrysotile -- South Carolina) leads to the highest lung cancer rates. The emphasis on amphiboles is for mesothelioma -- the real involuntary risk for school children. For this we believe the evidence is clear (please see enclosed

letter to Science from Drs. Langer and Nolan -- ex Mt. Sinai workers). It is well summarized by Dr. Douglas Liddell in the Harvard Symposium. (Dr. Liddell is a McGill University Epidemiologist of international stature with no axe to grind and without industry or other connections.) Please note 1) the use of crocidolite was effectively banned in the United Kingdom many years ago, and 2) amphiboles can be identified in bulk asbestos in place.

(3) Our emphasis on the low risk to Society is based on air sampling -- the fibers have to be respirable and lung depositable to cause any disease. We provided a worse case scenario -- please seen enclosed letter from Dr. Crump -- air borne levels are probably lower than we stated. Further the estimates of mesothelioma risk by Weill and Hughes (my testimony) are also a worst case scenario.

(4) EPA testimony by Linda Fisher is clearly a change in language and a different emphasis and seemed in truly measured tone to me.

(5) Again, may I stress the comments apply to society in general -- abatement workers and some maintenance workers need protection -- an OSHA function.

Thank you for your attention,

Yours sincerely,

J. Bernard L. Gee, M.D.
Professor of Medicine

JBLG:mlp
Enclosures

CC: Senator M. Wallop
Morton Corn, Ph.D.
Brooke T. Mossman, Ph.D.

To the Editor:

The risk of developing asbestos-associated malignant diseases among passive occupants of buildings is perceived to be so great that the removal of all asbestos-containing products from these public buildings is now being considered by the U.S. Environmental Protection Agency. We believe, as do Mossman and colleagues (1) that this action is too broad and inclusive, will ameliorate in situations where amelioration may not be needed, and most importantly, is not supported by existing data.

For example, Mesothelioma risk is fiber type and dose dependent. Crocidolite, amosite and mixed fiber exposures, which include asbestiform amphiboles, have produced the vast majority of mesotheliomas in workers exposed to asbestos in occupational settings (2). Many detailed and systematic tissue burden studies support the epidemiological findings (3). The importance of fiber type may also be appreciated when considering the nature of the data used for calculating mesothelioma risk in EPA's estimates (4). The total mesothelioma mortality includes over 60% from the peritoneal form of the disease (4). Chrysotile exposure alone is associated only with pleural mesotheliomas in workers; a single verifiable case of the peritoneal form has yet to be seen (5). These observations are of special importance when considering that the principal fiber exposure to passive building occupants is to the chrysotile variety.

If one accepts the linear, no threshold model for fiber exposure and disease outcome amongst asbestos-exposed building occupants, then, if the interpretation of the model is correct, the use of average dose is an integral component of the risk calculation (4). Episodic release of fibers in buildings would have the same relevance in this model as tearouts in confined spaces had for the insulation workers. They are, therefore, of no computational consequence as far as the predictive model is concerned (4).

Some discussion of the EPA's estimated numbers of mesotheliomas among individuals exposed to low levels of fiber, is warranted. For example, 2.3 to 920 excess mesothelioma deaths (pleural and peritoneal forms) are estimated to occur in a population of 100,000 persons exposed to a fiber concentration of 0.01 fibers per ml for 40 years, starting at age 20. The lowest value extrapolates upward to 3,450 mesothelioma deaths per 100,000 persons exposed at a fiber level of 15.0 f/ml. [This latter level of exposure has been estimated for U.S. insulation workers exposed in the past (4)]. However, the total mesothelioma mortality experienced by the unionized asbestos workers in the United States has recently been reported to be 9.25% (6) of which about 5.76% is to the peritoneal form. This would calculate to 3,490 pleural mesotheliomas among 100,000 insulation workers. The EPA passive building occupant estimate therefore follows anticipated pleural effects for workers whose health experience is generally held to be 'catastrophic'. When factoring fiber types, fiber quality (e.g., lengths), and especially direct comparison of workplace fiber assays, obtained by light microscopy, with indoor ambient air assays, obtained by electron microscopy, the numbers of excess mesothelioma deaths estimated for passive building occupants appears to be the worst-case scenario rather than lowest estimate.

Passive building occupants are not to be grouped with, nor confused with, building maintenance or custodial personnel. These workers carry potentially greater exposures to all fiber types, of all lengths and diameters. These workers require the resources of our public health institutions to help control and reduce potential exposures and attendant risks.

Mossman and colleagues (1) advanced the thesis that the United States should reexamine its asbestos policy, as it pertains to protecting passive occupants of public buildings, where asbestos-containing materials are found. They perceive the risk of asbestos disease to passive occupants as overstated and argue that the removal portion of this policy should be re-evaluated. We believe this is very good advice as their thesis is supported by many and diverse data sets, including those used by the EPA in their risk estimations.

We would like to close with another kind of advice concerning the urgent need for dialogue. Saul Bellow's introduction to The Closing of the American Mind contains the following admonition: "The heat of the dispute between Left and Right (read also scientists, legislators; environmentalists, pragmatists; plaintiffs, defendants; etc.) has grown so fierce in the last decade that the habits of discourse have suffered a scorching. Antagonists seem no longer to listen to one another."

We should accept this friendly reproof. The time is for discourse and listening.

Arthur M. Langer, Ph.D.
Director
Robert P. Nolan, Ph.D.
Associate Director
Environmental Sciences
Laboratory, Brooklyn College

## References and Footnotes

(1) B.T. Mossman, J. Bignon, M. Corn, A. Seaton, J.B.L. Gee. Asbestos: Scientific developments and implications for public policy. Science 247:294-301 (1990).

(2) J. Peto, H. Seidman & I.J. Selikoff: Mesothelioma mortality in asbestos workers: Implications for models of carcinogenesis and risk assessment. Brit. J. Cancer, 45, 124, 1982; R. Doll & J. Peto: Asbestos: Effects on health of exposure to asbestos. Health & Safety Executive, HMSO, London, 1985; G. Berry: Chrysotile and mesothelioma. In: Biological effects of chrysotile, Acc. in Oncol., 1, 123 (1986). J. Peto, Fibre carcinogenesis and environmental hazards. In: Non-Occupational Exposure to Mineral Fibres, IARC Sci. Pub. 90 J. Bignon, J. Peto & R. Saracci, Eds. IARC, WHO, CEC, Lyon, 457, 1989. R. Doll: Mineral fibres in the non-occupational environment: Concluding remarks. In: Non-Occupational Exposure to Mineral Fibres, IARC Sci. Pub. 90, J. Bignon, J. Peto & R. Saracci, Eds. IARC, WHO, CEC, Lyon, 511, 1989. See the following papers in same volume, Section on Risk Evaluation: J. Peto; J.M. Hughes & H. Weill. Also, Symposium of Health Aspects of Exposure to Asbestos in Buildings. Harvard University, Energy and Environmental Policy Center, December, 1989. Summary on Symposium, J.D. Spengler, H. Ozkaynak, J.F. McCarthy, H. Lee, p. 1, (1989); A.M. Langer & R.P. Nolan and D. Liddell in same volume; A.D. McDonald, & J.S. Fry: Mesothelioma and fibre type in three American asbestos factories: preliminary report. Scand. J. Work Environ & Health, 8, Suppl. 53, 1982.

(3) F.D. Pooley & R. Mitha, Fibre types, concentrations and characteristics found in lung tissues of chrysotile-exposed cases and controls; Determination and interpretation of the levels of chrysotile asbestos in lung tissues. In: The Biological Effects of Chrysotile, Acc. in Oncol., 1, (1986); A.M. Langer & R.P. Nolan; A. Churg & J.L. Wright; A.R. Gibbs, J.S.P. Jones, F.D. Pooley, D.M. Griffiths & J.C. Wagner. In: Non-Occupational Exposure to Mineral Fibres, IARC Sci. Pub. 90, J. Bignon, J. Peto & R. Saracci, Eds. IARC, WHO, CEC, Lyon 1989.

(4) United States Environmental Protection Agency. Airborne Asbestos Health Assessment Update. U.S. Government Printing Office, Washington DC, p. 198 (1986).

(5) M.J. Gardner, Summary Report in Occupational Exposure Limit for Asbestos, WHO, Oxford Meeting, 10-11 April, 91, 47 (1989).

(6) I.J. Selikoff. The Third wave of asbestos disease: Exposure to asbestos in place. Presented in seminar, Mt. Sinai School of Medicine, 8 Feb, 1990. Table 2.

Yale University

*J. Bernard L. Gee, M.D.*
*Pulmonary and Critical Care Section*
*Department of Internal Medicine*
*School of Medicine*
*5038 LMP*
*P.O. Box 3333*
*New Haven, Connecticut 06510-8057*

***Campus Address:***
***5038 LMP***
***333 Cedar Street***
***Telephone:***
***203 785-4195***

May 17, 1990

The Honorable Harry Reid
Chairman, Subcommittee on Toxic
Substances, Environmental Oversight,
Research and Development
U.S. Senate
Committee on Environment and Public Works
Hart Senate Office Building, Room 508
Washington, DC 20510

Attention: Stephanie Clough

Dear Senator Reid:

Dr. Lemen today forwarded to me a copy of the enclosed World Health Organization report (1989), from which he cited a half sentence (page 4 of his testimony; page 6 of WHO statement, section 4, sub (a).

I believe that therere is a real issue with the quotation since I believe it misrepresnts the WHO views in the following respects:

(1) Minor point: The WHO report embraces the notion that amphiboles (crocidolite, etc) are "in man" possibly more liable to cause lung cancer than is chrysotile (see page 6, section 4, sub (a).

(2) Major point: As we testified to your Committee this report also endorses the distinction between amphiboles and chrysotile as causes of mesothelioma:

Section 4, sub (c): "Pleural mesothelioma has been produced by all types of asbestos fibre, as experienced occupationally. In general, the human evidence suggests a much lower risk from exposure to chrysotile than to crocidolite or amosite."

Section 4, sub (d): "Peritoneal mesothelioma can be produced by crocidolite and amosite. This tumour has probably not been produced by chrysotile."

This major point is, I submit, of the utmost relevance to the school-AHERA issues.

I hope you will be able to incorporate this letter and perhaps the WHO Report into the record. You will note the international character of the group which drew up this document, as noted on pages 2 and 3.*

I thank Stephanie Clough for her phone conversation and receipt of this letter.

Respectfully yours,

J. Bernard L. Gee, M.D.
Professor of Medicine

JBLG:mlp
enclosure

CC: Dr. Lemen
Dr. Mossman

*The report referred to has been retained in committee files.

THE MOUNT SINAI MEDICAL CENTER
ONE GUSTAVE L. LEVY PLACE • NEW YORK, NY 10029-6574

Mount Sinai School of Medicine • The Mount Sinai Hospital

Philip J. Landrigan, M.D., M.Sc.
Ethel H. Wise Professor of Community Medicine
Chairman, Department of Community Medicine
Box 1057

(212) 241-6173
FAX: (212) 996-0407

Testimony of

Philip J. Landrigan, M.D., M.Sc., D.I.H.

Ethel H. Wise Professor of Community Medicine and

Director of the Division of Environmental and Occupational Medicine

Mount Sinai School of Medicine

# The Hazards of Asbestos in Buildings

Before the Committee on Environment and Public Works

United States Senate

Washington, D.C.

April 26, 1990

Testimony of

Philip J. Landrigan, M.D., M.Sc., D.I.H.

Ethel H. Wise Professor of Community Medicine and

Director of the Division of Environmental and Occupational Medicine

Mount Sinai School of Medicine

# The Hazards of Asbestos in Buildings

Before the Committee on Environment and Public Works

United States Senate

Washington, D.C.

April 26, 1990

Mr. Chairman and members of the Committee:

My name is Philip J. Landrigan, M.D. I am Chairman and Professor of the Department of Community Medicine and Director of the Division of Environmental and Occupational Medicine at the Mount Sinai School of Medicine in New York City. I am pleased to appear before you today to discuss the current status of the hazards posed by asbestos in buildings. In particular, I shall discuss the hazards posed by the presence in many thousands of buildings across the United States of chrysotile asbestos.

My experience with the hazards of asbestos stems from several sources. First, I am a board-certified specialist in occupational medicine and in my clinical work in occupational medicine at the Mount Sinai School of Medicine, I have seen and examined many workers with the diseases caused by exposure to asbestos.

Additionally, I have for the past three years been Chair of the Asbestos Advisory Board of the State of New York, a gubernatorial appointment. In this capacity I am responsible for advising the New York State Department of Labor, the New York State Department of Health, the governor and the legislature of the hazards of asbestos in place in buildings in New York State. A copy of our Board's most recent annual report is attached to my testimony.

I am also past Chair of the Committee on Environmental Hazards of the American Academy of Pediatrics; I am a board-certified pediatrician. In my capacity as Chair of the Committee on Environmental Hazards of the American Academy of Pediatrics I authored a document published by the American Academy of Pediatrics in 1987 entitled "Asbestos Exposure in Schools" (a copy of this document is attached to my testimony).

The health hazards of asbestos. Asbestos is a fibrous mineral which provides thermal insulation and is nonflammable. Because of these properties asbestos was used widely in building construction from the 1920's through the mid 1970's. It was used as pipe wrapping, boiler insulation, reinforcement in floor and ceiling tiles and in wall covering. Many millions of tons of asbestos were sprayed on building surfaces as acoustic insulation and for fireproofing until the practice of spraying asbestos was banned in 1972 in New York City and in 1973 by the U.S. Environmental Protection Agency.

Widespread occupational exposure to asbestos, primarily in the construction trades, occurred as a result of the use of the mineral. Exposures have been documented in persons who worked directly with asbestos such as asbestos insulators. Additionally, serious and extensive exposures have been documented in members of other trades such as carpenters, sheetmetal workers, plumbers and pipe fitters who did not themselves handle asbestos but who worked in close proximity to asbestos workers.

Asbestosis, lung cancer, mesothelioma, and a wide range of other cancers have been shown to be caused by exposure to asbestos.

Epidemiological studies conducted at the Mount Sinai School of Medicine and at other institutions in New York State and throughout the nation have established that all forms of asbestos, including chrysotile asbestos, have the capacity to cause these diseases. Additionally, this research has established that the incidence of asbestosis, lung cancers and other tumors is quantitatively related to cumulative asbestos exposure in a positive dose-response relationship.

By the end of this century, an estimated 30,000 to 50,000 premature deaths will have occurred in New York State and ten times that number across the United States as the result of occupational exposures to asbestos that occurred prior to 1980. The additional number of deaths which may ultimately result from exposure to asbestos in buildings is not yet known nor is the number of additional cases which may ultimately result from occupation exposure in the years subsequent to 1980.

## The Problem of Asbestos in Buildings

A very large number of buildings in New York State and across the United States contain asbestos. Although no statewide survey has been undertaken, a survey in New York City in 1988 showed that two thirds of 900 buildings sampled city-wide contained asbestos. This asbestos was in good condition in 13% of the buildings, in fair condition in 68%, and in poor condition in

19%. Asbestos in poor condition, which has been fractured or damaged by water becomes brittle or friable. When such asbestos is disturbed in any way, asbestos fibers can intermittently become airborne. Once airborne these fibers can be inhaled and will, in some persons, eventually and inevitably cause cancer.

Today as buildings constructed with asbestos over the past six decades begin to age and deteriorate, and as plans are made for the renovation and demolition of many of these buildings, serious potential exists for a new wave of occupational disease to asbestos among persons in New York State and across the United States who are engaged in the repair, renovation and demolition of these buildings. Potential hazard exists also for a serious environmental exposure to asbestos among residents, tenants and users of these buildings, including school children, office workers, maintenance workers, janitors, the elderly, and members of the general public.

The American Academy of Pediatrics has projected that over the next 30 years approximately 1000 deaths from mesothelioma and lung cancer will result among persons in the United States who were exposed to asbestos in school buildings when they were schoolchildren (range of estimates: 100-7000 cases). This projection is similar to conclusions reached by the Centers for Disease Control and the U.S. Environmental Protection Agency. The additional number of deaths from these diseases that will result from exposures in offices and other buildings in this population is not yet known.

The carcinogenicity of chrysotile asbestos. Recent articles published in Science and in the New England Journal of Medicine by Mossman, Gee and colleagues have argued that little, if any, cancer risk arises from exposure to chrysotile asbestos. These authors argue that the amphibole forms of asbestos--tremolite, amosite, crocidolite--have substantially greater carcinogenic potential than chrysotile asbestos. This theory is termed the "Amphibole Hypothesis."

It is the opinion of our group at the Mount Sinai School of Medicine, as well as of the New York State Asbestos Advisory Board of which I am Chair, and of the American Academy of Pediatrics of whose Committee on Environmental Hazards I am past Chair that these views are mistaken and ill founded. Moreover, it is our opinion that these views, if widely propagated and acted upon will result in the adoption by the public and by state and local agencies of cavalier and therefore extremely hazardous policies towards the clear and present dangers to health that are posed by asbestos in buildings. Such policies, if adopted, will result in unnecessary and preventable deaths.

Mr. Chairman and members of the Committee, I would like now to discuss with you in detail the basis for my view that chrysotile asbestos is extremely hazardous and highly carcinogenic.

First, in their articles Drs. Mossman and Gee and colleagues dismiss the 67 or more cases of mesothelioma that have occurred among

Quebec chrysotile asbestos miners and millers as "attributable to fibrous tremolite." They make this claim on the basis of the finding that lung burdens of tremolite in these individuals were higher than those of chrysotile. However, as an index predictive of mesothelioma, "lung burdens" of fiber types are nearly worthless. Chrysotile is a labile mineral that may disappear from lung tissue years before a postmortem analysis of tissue burden is done. This disappearance occurs because chrysotile, in contrast to amphibole asbestos, splits apart longitudinally in tissue and can partially dissolve in body fluids. Mossman, Gee, et al. ignore this possibility and ignore the likelihood that carcinogenic damage initiated by chrysotile occurs long before the disappearance of the fiber. Instead, they imply that it is the 1% contamination of Canadian chrysotile asbestos by tremolite that caused the mesothelioma. In my opinion this argument is specious. Since, after all, the tremolite burden is directly proportional to the amount of chrysotile asbestos inhaled, measurement of the lung burden of tremolite is in fact nothing more than an indirect index of chrysotile dose.

The fallaciousness of the tissue burden argument advanced by Mossman and Gee can be seen further by considering mortality studies of asbestos-exposed workers when the results are analyzed in terms of quantitative exposure. In studies of asbestos textile production workers, whose exposure was primarily to chrysotile asbestos, the percentage of nonchrysotile fiber ranged from 0-2% plus an additional 1% tremolite contamination. In these studies, the percentage increase in lung cancer for a one year exposure to 1 fiber/cm$^3$ ranged from 1 to 2.8/fiber year/cm$^3$ of cumulative exposure. In five other studies where workers were exposed to asbestos containing 100% amosite, 60% chrysotile plus 40% amosite and 80-90 chrysotile plus 10-20% crocidolite, amosite or both, the risk of lung cancer per fiber exposure was virtually the same as that observed in the population of workers exposed to predominantly chrysotile asbestos. Even a pure crocidolite exposure in miners demonstrated a similar risk. Were the "amphibole hypothesis" put forth by Mossman and Gee correct, the risks of cancer in the chrysotile asbestos textile studies would have been at least 100 times less than were actually seen.

There is to be sure, a significantly lower lung cancer risk per fiber exposure associated with chrysotile mining and milling as compared to chrysotile asbestos textile production. The reason for this difference is not fully understood. However, some, perhaps all of the greater risk in the textile mills results from the fact that in the mills, because of the presence of high-speed machinery which breaks up the asbestos, there exists a greater percentage of thin, uncounted but highly carcinogenic fibers. By contrast the fibers and particles in mining and milling are relatively large and coarse.

In further argument against the amphibole hypothesis advanced by Mossman and Gee, it has been observed that the risk of mesothelioma per fiber exposure in three studies where fiber exposure can be estimated directly, is identical for exposures to 98% chrysotile plus 2% crocidolite, 60% chrysotile plus 40% amosite and 100% amosite, respectively.

Data on the carcinogenicity of chrysotile asbestos in humans are corroborated by similar data obtained in experimental inhalation studies in laboratory animals. For equal levels of exposure, the greatest number of mesotheliomas was produced in these studies by chrysotile asbestos.

Drs. Mossman and Gee state that the "rod-like amphiboles are able to penetrate the peripheral lung more readily than chrysotile fibers which are curly, can occur in bundles and can be intercepted at airway bifurcations." While a typical mine specimen of chrysotile, contains a curly, nonrespirable fraction, a substantial proportion is, in fact, respirable. This respirable fraction, including the thin sublight-microscopic, most highly carcinogenic fibers, increases in quantity in successive stages of product manufacture and use. Contrary to the assertion of Mossman and Gee that amphiboles more readily penetrate the pleura than do chrysotile fibers, an analysis actually undertaken by one of their co-authors on the Science article of fiber types found in lung parenchyma and parietal pleura of workers exposed to both chrysotile and amphibole asbestos concluded that "in pleural tissues short chrysotile fibers frankly outnumber long fibers of amphibole type." I fail to understand why Mossman and Gee now repudiate this important finding by one of their co-authors. It should be noted that most mesotheliomas occur in the parietal pleura and that measurements of fiber levels in this tissue are likely to be a more relevant measure of actual target tissue exposure than are lung tissue burdens.

In conclusion Mr. Chairman and Members of the Committee it is my professional opinion backed by the experience of colleagues in the New York State Asbestos Advisory Board and the American Academy of Pediatrics, that the arguments advanced by Mossman and Gee are fallacious and ultimately are dangerous to human health.

In an effort to set the record straight on the hazards of asbestos in place in buildings, the Collegium Ramazzini, an international society dedicated to the advancement of occupational and environmental health has scheduled a major three-day conference on the hazards of asbestos in buildings. This conference is to be held in New York City on June 7, 8 and 9, 1990. I invite all of you to attend. We anticipate that the correct and accurate information that will be disseminated at this conference will help to counter the mischievous and highly dangerous mis-information which has been put forth by Drs. Mossman, Gee and their colleagues.

Thank you. I am prepared to answer questions.

NATIONAL SCHOOL BOARDS ASSOCIATION

Fifty Years of
Educational
Leadership
1940-1990

TESTIMONY

on behalf of

THE NATIONAL SCHOOL BOARDS ASSOCIATION

on

# IMPLEMENTATION OF THE ASBESTOS ABATEMENT PROGRAMS IN SCHOOLS and REAUTHORIZATION OF THE ASBESTOS SCHOOL HAZARD ABATEMENT ACT OF 1984

before the

Senate Subcommittee on
Toxic Substances, Environmental Oversight, Research and Development

April 26, 1990

Presented by

Toni Siskin
Chairman
Florida School Boards Association
Federal Relations Network
and
Board Member, Broward County School Board
Ft. Lauderdale, Florida

Also present for NSBA:

Thomas A. Shannon
Executive Director

Michael A. Resnick
Associate Executive Director

Katharine L. Herber
Legislative Counsel

NSBA
LEADERSHIP FOR PUBLIC EDUCATION

1680 Duke Street
Alexandria, Virginia 22314
(703) 838-NSBA
FAX: (703) 683-7590

## I. INTRODUCTION

I am Toni Siskin, Chairman of the Florida School Boards Association Federal Relations Network and a member of the Broward County School Board. On behalf of the National School Boards Association (NSBA), I am pleased to have this opportunity to testify before the Senate Subcommittee on Toxic Substances, Environmental Oversight, Research and Development on implementation of the asbestos abatement program in schools and reauthorization of the Asbestos School Hazard Abatement Act of 1984.

NSBA is the only major education organization representing the over 95,000 locally elected and appointed school board members across the nation. Currently marking its fiftieth year of service, NSBA is a federation of state school board associations with direct local school board affiliates, constituted to strengthen local lay control of education and to work for improvement of education. Nationwide, local school board members are politically accountable to their constituents for the prudent operation and fiscal management of the local school districts they serve. As government officials, school board members are uniquely positioned to judge federal legislative programs purely from the standpoint of public education, without consideration to their personal professional interest.

## II. OVERVIEW

There are approximately 33,000 local education agencies (LEAs) in the United States which contain no less than 96,000 school buildings. Following passage of the Asbestos Hazard Emergency Response Act (AHERA), each LEA was required to inspect each school building under its jurisdiction for the presence of asbestos, develop a management plan for each school building which was found to contain asbestos containing materials, and implement the management plan no later than July 9, 1989. Moreover, each step in the AHERA process requires that LEAs use inspectors, management planners and asbestos workers who are accredited by the Environmental Protection Agency (EPA).

EPA originally estimated the total cost of LEA compliance with AHERA to be approximately $3 billion. Although public school districts consistently maintained that the EPA estimate was understated, data in support of that position was unavailable until 1989, when NSBA conducted a survey of 671 of the 17,000 public LEAs. The NSBA survey results revealed that by April 1, 1990, 671 public LEAs would have expended nearly one-sixth (over $464 million) of the total amount EPA estimated AHERA compliance would cost all LEAs over the lifetime of asbestos in school buildings. Based on the initial survey results, NSBA believes that it is not unreasonable to assume that the actual cost of public school district (only) compliance with AHERA will exceed $6 billion over the lifetime of asbestos in school buildings.

Despite the significant cost of AHERA compliance, the only federal money available to LEAs, who must meet the stringent federal standards, is that available through the Asbestos School Hazard Abatement Act of 1984 (ASHAA). ASHAA instituted a program under which both public and private local education agencies (LEAs) may apply for a loan and/or grant to supplement the cost of activities undertaken in response to the presence of asbestos in school buildings. During the period 1985 through 1988, 1,819 LEAs submitted loan and/or grant applications to the Environmental Protection Agency (EPA) covering 12,706 asbestos abatement projects totalling $929 million. Of those applications, EPA awarded $157 million (or 17 percent of the total costs requested) to 642 LEAs.

In 1986, The Asbestos Hazard Emergency Response Act (AHERA) amended ASHAA to provide for the establishment of an Asbestos Trust Fund to provide additional financial resources to needy schools. The amendment authorized Congress to appropriate $25 million a year in fiscal years 1987 through 1990 to the Trust Fund and required that all loan repayments would be paid into the Trust Fund account. However, Congress has never appropriated any money to the Trust Fund. Moreover, loan repayments have resulted in a Trust Fund balance of approximately $8 million (A/O June, 1989), such funds have not been made available to needy schools.

## III. CONGRESS MUST INCREASE THE AMOUNT OF FINANCIAL ASSISTANCE AVAILABLE TO LEAS UNDER THE AHSAA PROGRAM

Following enactment of AHERA, LEAs were forced to immediately undertake complex and expensive compliance activities which were in addition to, and not in substitution for, any other activity LEAs are required by law to undertake (or services LEAs are required by law to provide). In most instances, the absence of adequate state or federal financial assistance has required LEAs to cut education programming in order to pay the cost of AHERA compliance. Moreover, many LEAs anticipate that further reductions in basic education services will be required to meet the cost of new rules governing re-roofing and roofing repair projects.

For instance, in my school district alone, we originally estimated the total cost of our asbestos program to be $24 million. Nevertheless, in the wake of new rules governing roofing projects, we have been advised that we can expect the actual cost of the asbestos program to increase between $10 million to $20 million over the next several years!

Not unlike school districts across the country, the Broward County School District is facing inordinate demands on its limited resources. In large measure, many of those demands are the result of federal laws which impose significant new requirements on LEAs, but which provide no funds for implementation (i.e., financial responsibility requirements for leaking underground petroleum storage tanks or hazardous waste disposal). School board members want to assure that our students and teachers enjoy a safe and hazard-free environment. However, due to a lack of federal funding, school board members are in the unenviable position of being forced to provide that safe environment at the expense of education.

When ASHAA was enacted into law, the projected cost of the asbestos in schools program was $3 billion. Since that time, we have learned that the cost of compliance for public LEAs alone is at least double that amount. Nevertheless, the ASHAA loan and grant program has never received full funding and monies held in the asbestos Trust Fund have never been released. Therefore, **we request that Congress recognize both its unmet and continuing obligation to LEAs by enactment of legislation to: 1) reauthorize the ASHAA loan and grant program at $1 billion; 2) immediately direct that amounts held in the Trust Fund account be made available to needy school districts; and 3) provide that in future years the Trust Fund account balance is available to needy school districts on an annual basis.**

## IV. NSBA URGES THAT REAUTHORIZATION OF ASHAA INCLUDE PROVISIONS TO IMPLEMENT CERTAIN RECOMMENDATIONS CONTAINED IN THE 1990 REPORT OF AUDIT ON THE ASBESTOS SCHOOL HAZARD ABATEMENT ACT

In September, the Inspector General for Audit released a Report of Audit On The Asbestos School Hazard Abatement Act (Audit Report Number E1E18-03-0161-9100486, September 20, 1989). NSBA urges Congress to include provisions in the bill to reauthorize ASHAA to implement certain recommendations contained in the report (see Attachment). Specifically, NSBA urges Congress to include in a final bill provisions which direct EPA to: 1) solicit and utilize applications on an annual basis, notwithstanding the fact that the Agency has not sought funding of the ASHAA loan and grant program in its budget request; 2) require that repayments for reimbursement projects commence no later than six months following the final award payment to the LEA; and 3) require that repayments for work-in-progress (WIP) projects commence no later than six months from the date work is completed and 90 percent of the award has been paid to the LEA.

NSBA believes that inclusion of these provisions in a final bill is necessary to ensure that LEAs do not encounter unnecessary delays in receiving ASHAA funding and to assure that the maximum amount of federal resources are available to needy schools.

## V. NSBA URGES THAT REAUTHORIZATION OF ASHAA INCLUDE AUTHORIZATION OF A GRANT TO FUND AN OBJECTIVE INTERNATIONAL STUDY OF THE ASBESTOS HEALTH HAZARD

Over the past year, the news media has published reports which suggest that the type of asbestos commonly found in school buildings does not pose a risk to human health. In many instances these reports are attributable to publication of a recent study undertaken by a group of scientists. Several members of the group have served as expert witnesses for defendant asbestos manufacturers in cases arising out of the presence of asbestos in buildings. In response to these reports (and in the absence of a new study which contradicts the study on which such reports are based) local taxpayers have begun to question the wisdom and necessity of their school district spending millions of dollars to comply with AHERA.

NSBA believes that Congress must assume a leadership role in responding to the confusion and alarm generated by the recent study by authorizing a grant of $500,000 to fund an objective international study of the asbestos health hazard. In that regard, to preserve the integrity and reliability of the Congressionally authorized study, NSBA believes that no individual should be allowed to participate in the study if (s)he has at any time appeared as an expert witness for either a plaintiff or a defendant in a case arising out of the presence of asbestos in buildings.

## VI. NSBA URGES THAT REAUTHORIZATION OF ASHAA INCLUDE FUNDING ADEQUATE TO ENSURE CONTINUED EPA COMPLIANCE ASSISTANCE LEAs

Since enactment of AHERA, the EPA Office of Toxic Substances has provided an invaluable service to LEAs through the development of numerous publications designed to apprise building occupants of the health hazards of asbestos and LEAs of the many activities they must undertake to comply with AHERA. EPA professional staff in both Washington, D.C. and EPA regional offices have been consistent in their willingness to assist LEA compliance with AHERA through participation in seminars and conferences for school board members, teachers, parents, and facility managers. Moreover, many of the activities undertaken by the Office of Toxic Substances have served as models to other offices within EPA (i.e., Office of Drinking Water) as they attempt to implement environmental laws which apply to LEAs and other units of local government.

NSBA believes that the success of school district compliance with AHERA will, in large measure, depend on the continued availability of assistance from the Office of Toxic Substances. Because that is so, NSBA urges that reauthorization of AHSAA include funding adequate to ensure that the current level of EPA assistance to LEAs is continued without interruption.

United States
Environmental Protection
Agency

EPA

# Report of Audit

## REPORT OF AUDIT ON THE ASBESTOS SCHOOL HAZARD ABATEMENT ACT (ASHAA)

*AUDIT REPORT NUMBER E1E18-03-0161-9100486*

*SEPTEMBER 20, 1989*

## FINDINGS AND RECOMMENDATIONS

### 1. EPA NEEDS TO AWARD ASHAA FUNDS MORE EFFECTIVELY

EPA's implementation of the application process in the ASHAA program has decreased the effective utilization of over $34 million in ASHAA funds. During fiscal years 1987 and 1988, EPA did not allow sufficient time to solicit new applications prior to awarding ASHAA funds. Instead, EPA utilized applications on hand for projects which were not significant enough to receive funding in the prior year. Many of these projects were boiler rooms with minor damage instead of classrooms with major damage and significantly more exposure hours. EPA could have used the funds more effectively if awards were made using data in the new applications. By funding new applications, we estimate that an additional two million exposure hours would have been abated on projects with major damage.

The change in the application process was made necessary by EPA not allowing sufficient time to solicit new applications within the Congressional deadlines for awarding the funds. The intent of the Congressional deadlines was to ensure funds are awarded timely so that LEAs can begin work in the summer months. Congress has allowed ample time for new applications in the deadlines provided EPA initiates the award cycle in a timely manner. However, EPA has routinely resisted the ASHAA program by not seeking funding for this program in its budget request to Congress. The Agency's policy not to participate in the ASHAA program has in the past resulted in Congress approving a joint resolution forcing the Agency to spend the ASHAA funds. This discord between the Agency and Congress concerning the continuance of this program has delayed the release of ASHAA funds until well into the fiscal year. To compensate for the funding delays, EPA staff had to expedite the application process by using previous year applications to award ASHAA funds. These old applications contained many low priority projects, and in part, because of the low priority, were not funded in the previous year. The funding of old applications by EPA was not the most effective use of ASHAA funds.

The delay in receiving ASHAA funding, combined with the Congressional deadlines, makes it extremely difficult for the Hazard Abatement Assistance Branch (HAAB) to properly administer the ASHAA program. HAAB personnel cannot ensure the funds are used most effectively when the funds do not become available to the Agency until one month before the Congressional deadline to award these funds elapses. EPA has the fiscal responsibility to ensure ASHAA funds are used effectively. We recommend that the Agency solicit and utilize applications on an annual basis and in a timely manner prior to awarding ASHAA funds for the fiscal year. If HAAB cannot obtain new applications within the Congressional deadlines, the Agency should request a time extension from Congress.

Prior to awarding loans and grants, each LEA's application is ranked by EPA in accordance with the guidance in the Act. The applications are evaluated based on the physical characteristics of the asbestos hazard in the school. Several key indicators are included in this hazard categorization and ranking; such as, degree of damage (major or minor), exposure (direct or through an air plenum) and exposure hours (weekly exposure hours). Those schools with severely damaged asbestos are ranked in Category I and schools with minor damage are ranked in Category II. The exposure hour total is derived for a project area by multiplying the number of people (students or employees) exposed with the amount of hours exposed each week (persons X hours/day X days/week). For example, a classroom used for five one-hour classes of 30 students five days a week has an average weekly exposure hour total of 750 (30 students X 5 classes X 5 days). The combination of damage and the exposure hours results in a unique ordering or listing of all projects, known as the National Hazard Ranking (NHR).

Of the two project characteristics (damage and exposure hours), damage is more important because EPA ranks projects with major damage and one exposure hour higher than a project with minor damage and 100,000 exposure hours. Projects with major damage include asbestos containing material that is dislodged, hanging or missing, while projects with minor damage only require evidence of some physical contact not severe enough to dislodge portions of the asbestos containing material. The effect of the classification of either major (Category I) or minor (Category II) damage can be substantial because EPA does not consider the square footage of the damaged area. To illustrate the difference, one project with major damage could include dislodged asbestos in several classrooms exposing thousands of school children while another project with minor damage may include a boiler room with only some evidence of abrasions on the asbestos material. Accordingly, there is a significant difference in the health hazard associated with potential release of asbestos fibers between the two projects. To ensure ASHAA funds are used effectively, the Agency has to fund the projects of needy LEAs with the most serious health hazards.

The ASHAA law required that states submit new applications on an annual basis. This is important because applications need to reflect current and accurate information on such items as the degree of hazard, costs of abatement and the financial condition of the LEA. All of these items can change dramatically within a year. Accordingly, EPA should rank applicants annually to ensure ASHAA funds are targeted to the needy LEAs with the most hazardous projects.

Several factors contributed to not soliciting new ASHAA applications. In FY 1987, Congress directed EPA to accelerate the award process by ensuring awards are made by April 1, 1987. This would enable school districts to complete necessary asbestos abatement work prior to the end of the 1987 summer school recess.

While Congress wanted EPA to expedite the award process, EPA requested that Congress rescind the ASHAA funds in FY 87 as part of the budget-cutting effort. The Assistant Administrator of OPTS has stated in written testimony to a Congressional Subcommittee that:

> "... direct Federal funding of abatement projects in schools does not represent the most effective use of Federal resources."

However, Congress approved a joint resolution forcing the Agency to spend the ASHAA funds appropriated for FY 87. This resolution was not approved until March 1987, five months into the fiscal year. Nevertheless, EPA still attempted to meet the award deadline of April 1, 1987.

To accommodate the April 1 deadline, EPA decided to have two award cycles instead of one. The first award cycle was for $34.2 million awarded to projects left over from qualified applications submitted in 1986. This was necessary because new applications could not have been obtained by the April 1 deadline. However, most of the projects with major damage and high exposure hours were already funded in 1986. Many of the remaining projects from 1986 consisted of less significant projects such as boiler rooms with minimal exposure hours or minor damage. As a result, EPA funded a total of 663 projects, of which only 171 or 26 percent had major damage with over 50 exposure hours per week. We found that 25 percent of the funded projects were for small areas such as boiler rooms, storage rooms and tunnels with exposure hours ranging from only 2 to 20 hours per week.

Subsequent to the first award cycle on April 1, 1987, EPA obtained new applications for approximately $8 million to be awarded on May 29,1987. This amount was set aside to ensure that each state received $250,000 provided the state had enough qualified projects. In this second round of new applications, projects totalling $94 million qualified for funding based upon EPA's hazard and financial need criteria. Many of these projects were far more hazardous than the left over projects from 1986. However, EPA only had $8 million remaining in FY 87 funds. Approximately $5 million of the $8 million was needed to ensure that each state received the minimum of $250,000. Consequently, EPA was only able to fund 66 of 1,769 potential projects. Furthermore, 65 of the 66 projects were funded out of hazard sequence with over one million dollars awarded to projects with minor damage.

The next chart illustrates the positive effects that could have been obtained by awarding the $34 million towards new applications ranked as Category I.

## OLD APPLICATIONS VS. NEW APPLICATIONS

### ACTUAL AWARD 1987 ROUND 1 - OLD APPLICATIONS

| | EXPOSURE HOURS | AMOUNT (MILLIONS) |
|---|---|---|
| Category 1 | 682,843 | $ 12 |
| Category 2 | 1,781,769 | 22 |
| Total Funded Category 1 Exposure Hours | 682,843 | $ 34 Million |

### POTENTIAL AWARD 1987 ROUND 1 - NEW APPLICATIONS

| | | |
|---|---|---|
| Category 1 (Funded 1987 Round 2) | 454,308 | $ 7 |
| Category 1 (Funded 1988) | 2,164,545 | 23 |
| Category 1 (Unfunded 1988) | 227,614* | 4 |
| Total Category 1 Exposure Hours | 2,846,467 | $ 34 Million |

* Estimated - assuming $12 million could abate 682,843 exposure hours in 1987, $4 million could abate 227,614 exposure hours (4/12 X 682,843)

If EPA utilized the $34 million Round One award amount toward the new applications, the above chart illustrates that EPA could have abated an additional 2.2 million exposure hours for projects with major damage (2,846,467 - 682,843). The health hazard associated with exposure hours from major damage (Category I) is far more severe than exposure hours from minor damage (Category II). Major damage represents asbestos containing material that is dislodged, hanging or missing while minor damage only requires evidence of some physical contact not severe enough to dislodge the asbestos material.

A similar situation occurred in FY 88, when the President did not sign the Congressional Appropriation language until December 22, 1987. In this appropriation, Congress required a March 1, 1988 award date for $23 million in ASHAA loans and grants. Accordingly, EPA used the FY 87 priority list, which was now almost a year old, to satisfy the impending Congressional deadlines. The effect of using the old listing in FY 88 was not as significant as in FY 87, because in FY 87 only $8 million was awarded to the new applicants. Consequently, a significant number of major projects remained on the list for funding in FY 88. However, we believe that a new round of applications would, as in the previous rounds, have funded more high priority projects than the left over projects from FY 87.

Agency Reply to OIG Draft Report

OPTS agrees with the OIG that annual solicitation of new school applications is preferable. However, this has not always been possible, given late appropriations, the congressional deadlines mandated by the ASHAA appropriation language and the federal requirements for application review and approval.

The Agency has made every effort to solicit new applications each year, so far as funds were provided and sufficient time was available to accomplish the lengthy application approval, distribution, completion, and review process. In fact, EPA has used applications which were previously on hand only twice, in 1987 and 1988. In 1987, EPA had about a month and, in 1988, the Agency had approximately two months to make awards, once funds were available.

Auditor's Comments

The Agency has responsibility to ensure ASHAA funding is used most effectively. We recognize that the Agency is faced with a number of constraints in adequately administering this Program. However, when these constraints such as late appropriations and Congressional deadlines make it impossible to properly administer the program, the Agency must not sacrifice the effectiveness of the ASHAA program. The Agency must allow the Hazard Abatement Assistance Branch adequate time to properly administer the ASHAA program. Adequate time would enable EPA to solicit new applications from LEAs with the most serious and current health hazards. If adequate time is not available, the Agency should request a time extension from Congress.

RECOMMENDATION

We recommend that the Assistant Administrator For Pesticides And Toxic Substances solicit and utilize applications on an annual basis and in a timely manner prior to awarding ASHAA funds for the Fiscal Year. Whenever possible, EPA should send out applications early, rather than wait until funding is approved. This would give EPA additional time if funding was delayed, and would allow the Agency to comply with Congressional deadlines in awarding the funds.

## 2. EPA NEEDS TO REVISE REPAYMENT TERMS FOR ASHAA LOANS

EPA allows an inordinate amount of time to begin repayment of some ASHAA loans. We estimate that by establishing a more reasonable repayment schedule, EPA could have returned an additional $1.5 million to the Asbestos Trust Fund by December 1989 plus an additional $700,000 each year thereafter (See Appendix A). The additional resources could have provided more loans and grants to other financially needy LEAs for their asbestos abatement. EPA allows all loan recipients a two year grace period after the award date before requesting repayment of the loan to begin. However, the work on many of the funded projects had already been completed prior to the award date or was finished within a year of the award date. In these instances, EPA paid 100 percent of the loan within a few months of the award date. This allows the LEA use of interest-free money for as long as two years before beginning a loan repayment program. We believe EPA should require LEAs to commence repayment within six months after completion of the abatement work. This modification to the loan agreement will enable EPA to fund additional health hazards at other financially needy LEAs.

According to the Asbestos School Hazard Abatement Act (ASHAA), all loans awarded under ASHAA will be interest free and will have a maturity period of twenty years or less. The law also provides that EPA determine the time and amount of repayments within the 20 year time frame. EPA decided that repayments will be made in equal, semi-annual, installments (of not less than $2,500 each) beginning two years after the loan offer is made. Repayments will continue in installments for 18 years or until the balance is paid in full. As stipulated in the Asbestos Hazard Emergency Response Act of 1986, all loan repayments under ASHAA will go to an Asbestos Trust Fund. This fund will be used by EPA to award additional loans and grants to financially needy schools.

EPA funds two types of projects. The first type of project is called a "Work-In-Progress" (WIP) project. The WIP project consists of abatement work typically started after the award date. On WIP projects the LEA requests funds to pay for costs incurred during work in progress. The second type of project is a "Reimbursement" project, whereby all the abatement work was complete prior to the award, but after January 1, 1984. The Act provides that EPA cannot award financial assistance for abatement actions completed prior to January 1, 1984. Accordingly, EPA stated that any project completed after that date is eligible for reimbursement. On "Reimbursement" projects, EPA policy states that LEAs may receive the entire loan within 90 days of the award date.

Regardless of the type of project, EPA allows a two year grace period before requesting the first repayment. This grace period coincides with the two year project period which EPA allows for completion of the abatement work. Since many of the LEAs receive funds as the work transpires, the full amount of the loan is generally not received until the project is completed. Consequently, EPA decided to postpone the first loan repayment for two years after the award date, the maximum time for which the LEA has to complete work on the project.

We obtained a computer listing from the Grants Administration Division containing the type of funded project (reimbursement or WIP) for all awardees from fiscal years 1985 through 1988. We reviewed all reimbursement projects from this listing and any WIP projects with a loan amount greater than $100,000. Between 1985 and 1988, EPA had awarded 599 loans totalling $112 million to various LEAs. Discussion with OPTS personnel revealed that $17 million of the $112 million awarded as loans was for reimbursement projects and $95 million was for WIP projects.

LEAs received $17 million for reimbursement projects and had use of interest-free money for two years before any repayment was required. For example, one LEA was awarded a loan of $349,000 on July 28, 1986 for work completed prior to that date. The LEA received the $349,000 by November 1986. However, this LEA was not required to make the first of 36 repayments until December 1988, over two years later. The amount of the repayments is $9,700 semiannually over 18 years. Since this LEA already funded the work without an ASHAA award, we do not believe the LEA should be given a two year grace period before initiating repayment. This same LEA was awarded another loan for $240,000 in March 1987, and received the full amount by June 1987. Again, the LEA was reimbursed for abatement work which was already completed and paid for by the LEA, however, the repayments on the ASHAA loan would not begin until June 1989. In both instances, we estimate that, had the repayments been initiated within six months of the award date, the Trust Fund would have an additional $43,200 for future ASHAA awards.

We believe EPA should revise the repayment terms for applicants with reimbursement projects. Repayment should begin on the first semi-annual repayment date following the final payment by EPA on the project, or two years, whichever is earlier. EPA's current repayment schedule requires LEAs to make repayments every six months, the end of June and December each year. We believe EPA could initiate repayment sooner under the same semi-annual repayment schedule thereby maintaining the same uniformity and cost effectiveness under the existing payback process.

In addition to the reimbursement projects, many of the WIP projects were completed within six to 12 months of the award date. This occurred because the award was made in early Spring with the work scheduled for that summer. When this happens, the LEA receives all funding within six to 12 months of the award and is not required to begin repayment until 12 to 18 months later.

For example, one LEA was awarded a loan of $652,823 on March 25, 1987 for work to be completed after the award date. The LEA completed the work and received the $652,823 by March 1988. However, this LEA was not required to make the first of 36 repayments until June 1989, over one year later. The amount of the repayments is $18,134 semiannually over 18 years. Since the LEA completed the work and received all of the award within one year, we do not believe the LEA should have use of the interest free money for an additional year before initiating repayment. We estimate that, had the repayment been initiated within one year of the award date, the trust fund would have an additional $36,268 for future ASHAA awards.

We were unable to compute the total number of WIP projects completed within the first year of the award. However, from our sample of 90 projects, 44 of the projects (49%) were completed early in the two year period. These LEAs completed the work from seven months to twenty months before the first repayment was due. EPA should initiate the repayment process promptly after the project is completed.

Furthermore, EPA should not wait two years until the awardees receive 100% of the award to require repayment. LEAs receive 90 percent of the award as costs are incurred, however, EPA retains 10 percent of the award until all of the final documentation is submitted. We found numerous applicants were not receiving the full amount of the award for several reasons, many of which were the fault of the LEA. One such reason was that the applicants were not submitting all the necessary documentation. We believe these applicants should be required to initiate repayment when the work is completed and 90 percent of the award is paid. This would allow EPA to accumulate more funds in the Asbestos Trust Fund for future awards.

### Agency Reply to OIG Draft Report

OPTS, acting on the OIG finding, is working with GAD and the Agency's Las Vegas Financial Management Center (LVFMC) to determine if a revised repayment system would be feasible and advisable for the 1990 or any future ASHAA award cycles. We expect a determination on this issue before the 1990 awards.

While we understand and appreciate the OIG's objectives in this matter, two factors in particular may mitigate against adopting the OIG recommendation. First, the period between an ASHAA award to a local education agency (LEA, which is a public school district or a private school) and the date of the first repayment installment, approximately two years later, was established to provide sufficient time for LEAs to conduct abatement actions or to complete specific financial procedures related to receiving the award.

Second, a uniform repayment schedule was selected to improve the efficiency of EPA's financial monitoring activities. While LVFMC and GAD are unable to presently quantify the additional costs and resource requirements which might be incurred by the OIG's recommended repayment system, which would track each individual ASHAA award on a separate payment initiation schedule, they would likely be significant. Further, this extra cost to EPA would not produce any immediate benefits to LEAs since funds repaid to the Asbestos Trust Fund are not presently available for redistribution to other financially needy schools.

Nevertheless, we agree that a speedy return of the money to the Asbestos Trust Fund would be beneficial in the event Congress allows EPA access to these funds. Thus, OPTS will continue to work with GAD and LVFMC to evaluate alternate repayment schedules and make any appropriate program changes in time for a 1990 award cycle.

Auditor's Comments

It is important to ensure the timely and effective use of ASHAA funds. Many ASHAA awardees have either already completed the asbestos abatement prior to receiving the EPA award or will complete the abatement within the first summer after the award. We recognize that the awardees must still complete certain administrative and financial procedures even after the abatement work is complete. However, we believe that EPA and the LEAs should be able to complete the necessary procedures within 90 days after completion of abatement. Accordingly, this would allow LEAs to initiate repayment as much as 18 months earlier.

Further, we are not suggesting that the Agency track individual awards on a separate time schedule. We are recommending that the Agency continue to use the present semi-annual repayment periods (June and December); however, the Agency should revise the loan repayment schedules to initiate repayments earlier. Since the repayment periods would remain the same, the additional costs and resources to revise the system would not be excessive. We believe the benefits from accumulating additional funds for needy schools would exceed the costs of revising the repayment schedules.

Finally, we are issuing a finding on the Asbestos Trust Fund which will hopefully resolve the Agency's inability to use the Fund. See finding entitled "ASBESTOS TRUST FUND NOT AVAILABLE TO LEAs."

RECOMMENDATION

We recommend that the Assistant Administrator For Administration And Resources Management modify the future loan agreement to revise repayment terms for applicants receiving loans. Repayment for reimbursement projects should commence six months after the award date. Repayment for WIP projects should commence on the next semi-annual repayment date after the work is completed or two years after the award date, whichever is earlier.

## LEGISLATIVE INFORMATION

TESTIMONY
OF THE
NATIONAL EDUCATION ASSOCIATION

ON THE
ASBESTOS SCHOOL HAZARDS ABATEMENT REAUTHORIZATION ACT
S. 1893

SUBMITTED TO THE
SUBCOMMITTEE ON
TOXIC SUBSTANCES, ENVIRONMENTAL OVERSIGHT,
RESEARCH, AND DEVELOPMENT
U.S. SENATE

PRESENTED BY
JOEL PACKER
NEA LEGISLATIVE SPECIALIST

APRIL 26, 1990

KEITH GEIGER, President
ROBERT CHASE, Vice President
ROXANNE E. BRADSHAW, Secretary-Treasurer

DON CAMERON, Executive Director

Mr. Chairman and Members of the Committee:

I am Joel Packer, a legislative specialist for the 2 million-member National Education Association which represents professional and support employees in elementary, secondary, vocational, and postsecondary schools throughout the nation. I appreciate the opportunity to comment on an issue of critical importance to health and safety of millions of American students and school staff: the threat of hazardous asbestos in the schools.

My testimony today will primarily focus on support for S. 1893, the Asbestos School Hazard Abatement Reauthorization Act, as well as NEA's continued support for the Asbestos Hazard Emergency Response Act (AHERA).

## Background on Asbestos Legislation

The issue of asbestos in schools has been the subject of extensive Congressional and Administrative review for over a decade. In 1979, the Environmental Protection Agency (EPA) instituted a technical assistance program to help schools respond to asbestos problems. In 1980, Congress enacted the Asbestos School Hazard Detection and Control Act, administered by the U.S. Department of Education, which established a program of loans and grants to assist schools financially with asbestos detection and abatement. Unfortunately, no funds were ever appropriated for this program.

In 1984, NEA was instrumental in the development and enactment of the Asbestos School Hazard Abatement Act (ASHAA) which transferred this program from the Department of Education to EPA and authorized $100 million per year to carry out the program. The authorization has since been increased to $125 million per year. Since that time, 1,571 schools with the most serious problems, and the fewest resources to address them, have received some $200 million to assist them with 2,194 abatement projects. These funds have helped eliminate more than 17 million hours of exposure to asbestos by students and school employees. In May 1990, EPA will award $44.7 million in funds for the program for FY90. Federal funds appropriated for grants and loans is only a fraction -- about 8.2 percent -- of the $3 billion the Environmental Protection Agency estimated it will cost for comprehensive asbestos abatement in accordance with AHERA. Other estimates project the cost to be as much as $6 billion.

The hazards of friable asbestos are well-known. Its link to cancer and other debilitating and potentially terminal diseases is widely recognized. EPA has estimated that as many as 15 million children and 1.5 million school employees work in more than 44,000 school buildings containing friable asbestos -- not just asbestos that is present and not likely to be disturbed, but asbestos that is easily crumbled and likely to deteriorate in locations that represent a serious threat to health and life. In addition, virtually all of our nation's 107,000 schools contain nonfriable asbestos, which can also release fibers under certain conditions.

Research shows that young children are particularly at risk. In 1983, the EPA's Office of Toxic Substances cautioned: "The age at which asbestos exposure occurs is very important in determining the lifetime risk of developing mesothelioma (cancer). This fact creates a special concern for asbestos exposure to children...A child exposed from age 5 to 10 will have about 10 times the chance of developing mesothelioma as an adult exposed to the same amount of asbestos between ages 35 and 40. In addition, children appear to be more susceptible than adults to (other) asbestos-related diseases."

**Attempts to Minimize the Dangers**

Articles published last year in the *New England Journal of Medicine* and *Science* magazine suggest that concerns about asbestos in schools are unfounded. These articles do not represent new research; they are simply reviews of pre-existing studies. NEA rejects the idea that "chrysotile asbestos, the type of fiber found predominantly in U.S. schools and buildings, is not a health risk in the non-occupational environment," as reported by Brooke Mossman, Morton Corn, Bernard Gee, et al. in *Science*.

This exact question has been reviewed by this Committee in July 1985 during a hearing on ASHAA. Former Senators

Stafford (R-VT) and Abdnor (R-SD) wrote to several scientists requesting their views on "the health effects of inhaled chrysotile asbestos." In response, Dr. James O. Mason, then director of the Centers for Disease Control, submitted a statement that concluded, "(Scientific studies) conclusively demonstrate that chrysotile asbestos is a hazardous substance and poses a substantial health risk when inhaled."

EPA in its July 1989 final rule on banning future manufacture, importation, and distribution of asbestos stated categorically that "It is well recognized that asbestos is a human carcinogen and is one of the most hazardous substances to which humans are exposed in both occupational and non-occupational settings." The EPA also stated, "All commercial forms of asbestos have been shown to produce lung tumors and mesothelioma... in laboratory animals with no substantial differences between the form of asbestos in carcinogenic potency." Moreover, this regulation was the result of three years of review and some 45,000 pages of comments.

The contention of the *Science* article is clearly out of touch, not only with these statements, but also with the conclusions of the Consumer Product Safety Commission, the National Institute for Occupational Safety and Health, and the American Cancer Society, among many others. The contention that asbestos in buildings is not a health threat has been answered by numerous well-qualified experts, including Dr. Christine Oliver of Harvard Medical School, Dr. Steven Levin of the Mount Sinai School of Medicine, and Dr. James Melius of the New York State Department of Health.

Dr. William Nicholson of the Mount Sinai School of Medicine challenged the conclusions of Mossman et al., specifically the contention that exposures of 0.002 fibers per cubic centimeter are not a health threat. Writes Nicholson, "It has been calculated that the lifetime risk for a 13-year exposure at this level, beginning at age five, ranges from 4-12 asbestos cancer deaths per 100,000 exposed...For a school population of 20 million pupils, this translates into 800-2,400 cases of cancer."

Most other carcinogens are regulated by EPA when projected to cause one cancer death per one million people, well below the projected cancer deaths cited here.

In fact, levels of asbestos in schools may be higher than the level of 0.002 f/cc, particularly in the absence of an asbestos management plan. In its February 1988 report to Congress on public buildings, EPA found that the mean level of asbestos in 41 surveyed school buildings was 0.03 f/cc. The highest reading found was 0.1 f/cc, equal to the action level of allowable occupational exposure established by the Occupational Safety and Health Administration (OSHA). Even the 0.03 f/cc level is more than 100 times higher than the exposure levels of 0.00024 f/cc suggested by Mossman et al.

**The Need for AHERA**

Moreover, the real concern is not with current average indoor air concentrations of asbestos. The impetus for AHERA stems from the fact that friable asbestos, unless properly maintained, will become damaged and release fibers. Even routine maintenance activities can lead to peak fiber release episodes of 100 to 1,000 times average levels. A 1977 study by Dr. Sawyer measuring asbestos levels in a college library found a mean level of 0.02 f/cc. And yet, routine activities, such as cleaning and moving books, resulted in airborne levels skyrocketing to 15.5 f/cc, while maintenance work, such as removing a section of ceiling, raised levels even higher: to 17.7 f/cc.

Indeed, while some publications have characterized current federal law concerning asbestos in schools as "fiber phobia" or "paratoxicology," recent evidence shows school custodial workers suffering disproportionately high levels of asbestos-related lung disease. The rate of such abnormality in a study by Mount Sinai was 39 percent for a group of New York City school custodians with at least 35 years of work experience. Interestingly, of those custodians who had no other asbestos exposure outside of schools, the abnormality was higher. A 1989 study of 121 Boston Public School custodians by Dr. Oliver of Massachusetts General Hospital found asbestos-related scarring of the lining of the lungs in 40 percent of these individuals, including 21 percent of those custodians without any other known asbestos exposure.

NEA strongly maintains our support for AHERA. Most critics of the statute have misrepresented what it does. AHERA does not require removal of asbestos in the vast majority of circumstances. The statute requires schools to inspect for asbestos, assess its condition, develop a comprehensive asbestos management plan, and implement appropriate response actions, including special operations and management procedures, repair, enclosure, encapsulation, or removal.

NEA and other responsible advocates have never contended that removal of asbestos was always the solution. Indeed, a July 1989 joint EPA/NEA/PTA publication, *The ABCs of Asbestos in Schools*, states "Most asbestos-containing material can be properly managed where it is. In fact, asbestos that is managed properly and maintained in good condition appears to pose relatively little risk to students and school employees. Accordingly, the AHERA schools rule rarely requires the removal of asbestos materials."

A thorough inspection and responsible, ongoing management of asbestos is warranted by the evidence of asbestos research and the investigations of school buildings across the nation. Even Dr. Corn, who attempts to discount the risk of asbestos in buildings, acknowledged in a statement before the House Subcommittee on Health and Safety on April 3, 1990, "...Asbestos must be treated with respect.

There should be requirements for surveying buildings to determine where the ACM (asbestos-containing material) is located, the occupants of buildings should be alerted to its presence and informed of the concentrations of measured concentrations of asbestos-in-air in the buildings...(And) the maintenance personnel in the buildings should be instructed in an O&M (operations and maintenance) plan containing specific procedures relative to their building and the specific maintenance that they perform." These elements are all part of AHERA.

Some Members of Congress have introduced legislation to repeal AHERA. We strongly oppose this and believe repeal would be totally irresponsible. As former EPA Administrator Lee Thomas stated in a February 26, 1988 letter to Congress, "...asbestos in schools...represents a potential health hazard that deserves careful attention. We should be very careful not to take steps which undermine the (AHERA school asbestos programs') completion."

AHERA was specifically designed to put in place a comprehensive, rational framework to clean up asbestos where it is presently a hazard and put in place preventive measures to manage in-place undamaged material. As of October 1989, 94 percent of all school districts had prepared management plans. Repeal would mean that schools would not have to do anything to respond to damaged asbestos, not have to follow worker and building occupant protection standards during abatement, not have to utilize workers who are accredited either by states or EPA, not have to notify parents, teachers, and other school employees of whether and to what extent asbestos is present in their school building, not have to meet the reoccupancy clearance levels after an abatement action, and not have to follow asbestos transport and disposal regulations.

Let me emphasize that, as of July 1989, AHERA provides school districts with a great deal of flexibility -- not only in which response action to choose, but also the timing of implementation. While there were strict deadlines for completing the inspection and preparing the management plan, there are few remaining deadlines beyond July 1989. Schools are required to conduct a visual review of asbestos material every six months, but the review does not have to be performed by an accredited person. Once every three years schools must conduct a formal reinspection. Other than that, schools may set their own schedule and select their response actions, based on the advice of the plan developer. A school can also revise its management plan in conjunction with the plan developer. One key condition for any response action is that it must be sufficient to protect human health and the environment.

A much more responsible alternative to repeal of AHERA is the amendment attached to the Clear Air Act. NEA has no objections to EPA sending additional information to schools about their options under AHERA. In fact, we have strongly encouraged EPA to do so and cooperated with EPA in the publication of the *ABCs of Asbestos*, as well as a publication soon to be released, *The Environmental Hazards in Schools Handbook*. The proposed ASHAA reauthorization allows up to 5 percent of funds each year to be used by EPA for training, technical assistance, and information dissemination.

The Clean Air Act would also require the Health Effects Institute (HEI) to study the health effects of different types of asbestos. We question the necessity of this study, but we do not oppose it. Dr. Arthur Upton, former director of the National Cancer Institute and currently head of New York University's Institute of Environmental Medicine, was recently selected to chair HEI's panel on literature review of asbestos. Dr. Upton disputed the claims of Mossman and Gee by stating "...abandonment of asbestos inspection and abatement is not justified" by their data.

NEA believes that any amendment that would weaken AHERA is not justified at this time. EPA is in the process of evaluating implementation and effectiveness of AHERA and we believe it would be prudent to wait for the results of these studies.

## The Need for Continued ASHAA Funding

In the most recent round of applications for ASHAA grants and loans appropriated for Fiscal Year 1990, some 862 local education agencies applied for funds amounting to almost $406 million to carry out 1,856 asbestos abatement projects. The $44.7 million Congress provided last year to fund ASHAA is sufficient to pay for only 11 percent of those requests.

Between FY85 and FY89, only 16 percent of the 9,704 schools seeking assistance under ASHAA have been funded. Over the lifetime of the program, about one-fifth of all local education agencies have requested funding under ASHAA. Some 40 percent of the projects proposed were considered Hazard Category I, the most serious rating in EPA's system for evaluating asbestos dangers. Fewer than one-third of even these high-priority projects have been funded under ASHAA.

Hazard Category I projects are characterized by friable asbestos-containing building materials exposed or in an air plenum and considered to arise from 1) damaged or significantly damaged thermal system insulation; 2) significantly damaged surfacing materials; or 3) significantly damaged miscellaneous material which has been isolated to protect human health and the environment.

The need for continued assistance under ASHAA is clear, and support for the program is widespread. NEA coordinates the Asbestos in the School Coalition, which has lobbied actively for increased ASHAA funding for the past six years. The 40 Coalition members include school groups, environmental, health, and labor organizations. Reasonable people may debate whether all asbestos in the schools represents a hazard. But no one can challenge whether the presence of airborne asbestos is a health hazard. And no one can challenge whether asbestos that is present in a state that is damaged or likely to be damaged must be abated in a responsible manner.

**Provisions of the Bill**

The Asbestos School Hazard Abatement Reauthorization Act (S. 1893/H.R. 3677) would reauthorize the program of grants and loans to schools to address serious asbestos hazards through FY95. It would increase the annual authorization from $125 million to $250 million. It is important to note that about 70 percent of the funds have been provided as loans to be repaid to the federal government.

In addition, the measure would make a number of improvements in the administration of the program. It would require EPA to distribute applications to local education agencies within 45 days of the enactment of any appropriation for ASHAA and require EPA to make awards no later than April 30 of each year. The provision will prevent problems, such as those that have occurred in the past, with delays in distribution of applications and awards. It will also prevent OMB from prohibiting EPA from distributing applications at all, as was the case in FY87.

Moreover, the legislation would require that LEAs must have prepared and be implementing a management plan in compliance with AHERA, and that abatement projects be carried out by AHERA-accredited personnel, to be considered for an award. The measure also allows 5 percent of ASHAA funds to be used to assist schools with reinspection and training. NEA strongly supports these improvements. At the same time, we strongly urge Congress to provide funding levels that meet the authorized levels. The most Congress has ever provided in a fiscal year for ASHAA awards to schools was $47 million in FY86 -- less than one-half of the authorized amount. Every year, the White House has recommended no new funds -- despite clear evidence that the hazards continue to exist. In fact, President Bush's budget for FY91, once again, requests no funds for ASHAA. In the past, the Office of Management and Budget has stated that "additional funding would go to low priority projects." And yet EPA's own statistics on applications shows this not to be the case. It is likely that costs to schools for implementing management plans will increase over the next few years.

The ASHAA reauthorization would provide funds to continue to assist schools that have demonstrated asbestos hazards and are in compliance with AHERA regulations for inspection and management. Moreover, the grants and loans are provided only to those schools with the most severe economic impediments to address the health threat. EPA reported in 1986 that 80 percent of the projects funded in the ASHAA program were in school districts where the per capita income is less than 65 percent of the national average; more than one-third of the awards went to schools where the per capita income is about 50 percent of the national average.

At present, funds repaid to the federal government from ASHAA loans are placed in the Asbestos Trust Fund established by AHERA. S. 1893 would be greatly improved by the addition of language that gives EPA authority to distribute such funds as they are repaid. The purpose of this Fund was to have repaid loans made available to provide additional ASHAA awards. OMB projects that about $25 million will available in the Trust Fund by FY91. However, funds can be spent from this Fund only subject to appropriations. Unfortunately, no money has ever been released from the Trust Fund and the $25 million therefore serves simply to contribute minutely contribution to reducing the overall deficit.

NEA believes ASHAA should be amended to give EPA the authority to provide ASHAA awards to schools that meet EPA's own criteria. Indeed, for any year in which qualified application requests exceed appropriated funds, EPA should provide Trust Fund moneys to these qualified applicants who would otherwise go unfunded.

Without question, funds for asbestos abatement -- when necessary -- will reduce the total resources available in a school district for the full range of programs and services necessary to provide quality educational opportunities. And we must not force those schools at the lower end of the economic scale to choose between quality education and the health and lives of its students and staff.

In addition, the Committee needs to examine the financial need criteria used by EPA in determining whether a district is eligible to receive ASHAA assistance. Since the program's inception, EPA has used only one factor -- per capita income of the school district for public schools. Those in the top 30 percent are automatically considered ineligible.

This standard fails to take into account the cost of the abatement project in relation to the school's overall budget. It ignores any differences in terms of variations of the cost-of-living across geographic lines, or any other circumstances. NEA recommends that the Committee direct EPA to consider factors such as these in determining financial need.

NEA strongly urges you to extend, expand, and improve the Asbestos School Hazard Abatement Act, and we pledge to work with you to see that the threat of asbestos and other environmental hazards in the schools are completely eliminated.

Thank you.

# TESTIMONY

GREGORY VEITH, FACILITIES AND CONSTRUCTION MANAGER, ARCHDIOCESE OF CHICAGO

COUNCIL FOR AMERICAN PRIVATE EDUCATION

BEFORE THE TOXIC SUBSTANCES, ENVIRONMENTAL OVERSIGHT, RESEARCH AND
DEVELOPMENT SUBCOMMITTEE OF SENATE ENVIRONMENT AND PUBLIC WORKS

TESTIFYING IN SUPPORT OF

REAUTHORIZATION OF THE ASBESTOS SCHOOLS HAZARD ABATEMENT ACT

APRIL 26, 1990

## Statement of Gregory Veith
Manager of Facilities and Construction
Archdiocese of Chicago
Representing the Council for American Private Education
April 26, 1990

I am Gregory Veith, manager of facilities, service and construction for the Catholic Archdiocese of Chicago. I am representing the Council for American Private Education. I am a structural engineer and general contractor responsible for the 393 school facilities of the Chicago Archdiocese, the seventh largest school system in the country. In this capacity I am the designated person handling the asbestos program from the inspections to the management plans to the design of removal. I thank the subcommittee for inviting me to testify today.

The Council for American Private Education (CAPE) is a Washington-based coalition of 14 national organizations representing private elementary and secondary schools. We include Catholic, Lutheran, Montessori, Hebrew Day, Independent, Quaker, Seventh-day Adventist, Christian Schools International, military, Solomon Schechter, Episcopal and Private Schools for Exceptional Children. In this country twelve percent of elementary and secondary students attend private schools, thirteen percent of our teachers teach in private schools, and twenty-five percent of all schools are private. There are some 27,000 private schools in all, serving 5,241,000 students. (National Center for Education Statistics)

CAPE strongly urges passage of S. 1893, reauthorizing ASHAA. ASHAA is the only source of federal funds supporting the asbestos abatement required under AHERA and those funds are desperately needed--now more than ever. Many schools have been spending large sums of money on asbestos abatement since asbestos was identified as a toxic substance in the 1970's. Before the 1982 Asbestos in School Rule went into effect, some schools abated voluntarily. The Rule mandated action which was costly in many cases. AHERA mandated additional action which has been costly in most cases.

Yet AHERA's requirements, which were far more stringent than the prior requirements, only went into effect last May when management plans were due at governors' offices. By that time, with the appropriations available from Congress, EPA could fund only a third of the school abatement projects they ranked as most hazardous. Since July, 1989 when schools were required to undertake abatement, estimated costs have escalated and are expected to remain high for several years to come.

Let me present you with some data from the private schools. The United States Catholic Conference (USCC), a member association of CAPE, conducted a survey this year on total projected costs for abatement (which included costs of inspection and management plans.) USCC surveyed its 176 dioceses. To date later than 45 days after appropriations have been made, and the need for swift approval or disapproval of those applications. Administrators have always been rushed to meet the deadlines. Our schools and all schools need a greater federal funding commitment for this federally mandated program, and some groups including the Catholic Conference are seeking an authorization of $1 billion a year for the first few years to remove the asbestos hazard as soon as possible.

Although the administration did not include funds for asbestos abatement in its budget, EPA has been helpful in working with the schools on both ASHAA and AHERA. We thank the Environmental Assistance Division for convening a meeting on re-thinking the financial needs analysis for private schools and for their continued communication on that and other topics. We hope that we can work to come up with an even more equitable formula for determining financial need--one that might draw from other federal programs, for example. We also think there may be a place for inclusion of a hardship factor imposed on schools by extraordinarily costly projects.

Given the figures of both public and private school abatement, it is clear that costs have far exceeded EPA's early estimate of $3 billion. Both public and private schools have had to cut back on their education programs in order to pay these extraordinary costs. At a time when schools are working so hard to equip children with the many skills needed for their success, we urge Congress to make a large commitment to help shoulder the costs of protecting their safety. It is now that schools need Congress's support reauthorizing ASHAA at the highest possible figure but not less than $250 million annually over five years. Thank you again for this opportunity.

attachment

105 have responded. The actual cost of the inspection and management plans plus the contractors' estimates on abatement total 429,869,143. That figure accounts for only 60 percent of the dioceses. Catholic schools alone will therefore have to spend in excess of $1 billion to cover asbestos abatement, and Catholic schools account for about half of the private school enrollment and 40 percent of the number of private schools.

Some other startling figures: the Norwich, CT diocese will spend an estimated $10 million, according to their contractor; the Bridgeport, $6.5 million; the Arlington, VA, $2.25 million; the Richmond, VA, $3 million; St. Louis, MO, $65 million; the Michigan combined dioceses, $75 million and the Pennslyvania, between $30 million and $50 million.

CAPE conducted a survey of its non-Catholic schools and found the following: the 93 Illinois Lutheran Church-Missouri Synod schools will spend about $3.7 million. The 20 Christian Schools International of Illinois and Indiana will spend over $1 million. The 25 Mid-Atlantic Seventh-day Adventist schools will spend about $2.2 million. Private schools in New York State alone will spend well over $100 million.

Private schools cannot pay for these projects by raising taxes and floating bonds. Instead they are forced to increase tuition, sponsor fundraisers, ask for donations and borrow from banks. Often education programs suffer, teacher salaries remain low, schools cannot afford new textbooks, other building repairs are postponed and sometimes scholarships are reduced. Epiphany Lutheran, an all black school in Brooklyn, had to assess each family $300 and lost some students as a result.

Some schools have closed because they could not pay the abatement costs. Emmanual Lutheran School, an all black school in Chicago, closed. The School on the Hill in Harlem closed. Van Nuis Baptist Day School in California closed. The Hudson Valley Lutheran Parochial School in Jersey City, New Jersey had to abandon its building, is leasing space in two locations and may close.

CAPE has actively participated in the Asbestos-in-Schools Coalition, which brings together groups representing teacher unions, school administrators, service employees, school boards, private schools and parents. Together we worked for the enactment of the Asbestos School Hazard Abatement Act (ASHAA) of 1984 and we particpated in negotiated rule making implementing the Asbestos Hazard Emergency Response Act of 1986 (AHERA). We all agree that schools are responsible for the health and safety of children and employees and that the asbestos hazard must be removed. Nearly all schools have complied with AHERA according to EPA, which reported a 96 percent compliance rate on submission of management plans.

CAPE supports ASHAA reauthorization. We emphasize in S. 1893 the need to get the loan and grant applications out not

Attachment A

## Diocesan-Wide Asbestos Cost Assessment

| State # of Schools | Inspections | Planning | Abatement |
|---|---|---|---|
| Alabama | | | |
| 24 Birmingham | 28,000 | 12,000 | 1, million |
| Alaska | | | |
| 2 Fairbanks | 75,000 | 75,000 | 100,000 |
| Arizona | | | |
| 24 Tucson | 16,000 | 11,000 | 305,000 |
| Arkansas | | | |
| 24 Little Rock | 39,677.58 | 39,677.59 | 6,240,150 |
| California | | | |
| 266 Los Angeles | 250,000 | 250,000 | 6 million |
| 48 Sacramento | 42,117.13 | 42,117.13 | 539,627 |
| 50 San Diego | 35,000 | 25,000 | 1,650,000 |
| 86 San Francisco | 250,000 | 250,000 | 1 million |
| 14 Stockton | 22,100 | 36,350 | 98,331 |
| Colorado | | | |
| 37 Denver | 87,000 | 88,000 | 2.8 million |
| Connecticut | | | |
| 55 Bridgeport | | | 1.2 million |
| 26 Norwich | | | 4 million |
| **Total #669** | **844,894** | **4,924,289** | **21,433,108** |

| **State**<br># of Schools | **Inspections** | **Planning** | **Abatement** |
|---|---|---|---|
| Delaware | | | |
| 36 Wilmington | | | 8 million |
| District of Columbia | | | |
| 108 Washington | 85,903 | 73,608 | 1 million |
| Florida | | | |
| 66 Miami | | | 5.7 million |
| 29 Orlando | | | 1.5 million |
| 19 Palm Beach | 12,410 | 14,000 | 1.8 million |
| 17 St. Augustine | | | 500,000 |
| 33 St.Petersburg | | | 438,000 |
| Georgia | | | |
| 16 Atlanta | | | 2.5 million |
| 18 Savannah | 4,905 | 15,312 | 550,000 |
| Idaho | | | |
| 13 Boise | 12,542.47 | 12,542.47 | 412,712 |
| Illinois | | | |
| 48 Belleville | 156,268 | 78,134 | 4,176,707 |
| 393 Chicago | 705,501 | 15,852,220 | 198,698,596 |
| 67 Joliet | 125,000 | 125,000 | 10 million |
| Indiana | | | |
| 30 Evansville | 38,000 | 38,000 | 3.5 million |
| 46 Ft. Wayne-So. Bend | | | 2 million |
| Total #939 | 1,140,529 | 16,280,816 | 61,947,278 |

| State # of Schools | Inspections | Planning | Abatement |
|---|---|---|---|
| **Iowa** | | | |
| 57 Dubuque | 52,000 | 52,000 | 3,746,000 |
| 42 Sioux City | 23,080 | 4,200 | 2.5 million |
| **Kentucky** | | | |
| 41 Covington | | | 1.2 million |
| 26 Owensboro | 13,682 | 13,682 | 400,000 |
| **Louisiana** | | | |
| 15 Houma-Thibodaux | 10,599 | 10,599 | 400,000 |
| 36 Lafayette | 16,317 | 23,500 | NA |
| 100 New Orleans | 116,200 | 116,200 | 3,506,800 |
| **Maine** | | | |
| 24 Portland | 36,791.85 | 9,600 | 7,235,796 |
| **Maryland** | | | |
| 101 Baltimore | 165,000 | 110,000 | 1.6 million |
| **Massachusetts** | | | |
| 192 Boston | | | 25 million |
| 28 Fall River | | | 2.5. million |
| **Michigan** | | | |
| 194 Detroit | | | 10 million |
| 17 Gaylord | | | 445,000 |
| 48 Grand Rapids | 56,519 | 53,241 | 43,998 |
| 23 Kalamazoo | | | 800,000 |
| 47 Lansing | 60,231 | 60,232 | 3,335,000 |
| 34 Saginaw | 91,900 | 52,000 | 1,674,000 |
| Total #1025 | 642,319 | 5,653,254 | 71,586,594 |

| State<br># of schools | Inspections | Planning | Abatement |
|---|---|---|---|
| Minnesota | | | |
| 39 St. Cloud | 44,512.98 | 45,479.09 | 90,836 |
| 122 St. Paul | | | 10 million |
| 30 Winona | 29,109 | 48,609 | 1,640,193 |
| Mississippi | | | |
| 23 Jackson | 17,678 | 17,688 | NA |
| Missouri | | | |
| 208 St. Louis | | | 65 million |
| 26 Springfield- Cape Girardeau | 4,730.04 | 4,730.04 | 1,972,112 |
| Montana | | | |
| 26 Helena | 7,500 | 6,325 | 200,000 |
| 15 Great Falls-Billings | 32,500 | 32,500 | 12,000 |
| Nebraska | | | |
| 29 Lincoln | 16,255 | 16,255 | 431,563 |
| 81 Omaha | | | 1.8 million |
| New Jersey | | | |
| 74 Camden | | | 7 million |
| 50 Metuchen | 125,000 | 100,000 | 7.5 million |
| 212 Newark | 175,500 | 461,130 | 2.8 million |
| 79 Paterson | 188,000 | 140,350 | 2.5 million |
| Total #994 | 640,785 | 732,716 | 100,946,704 |

| State<br># of Schools | Inspections | Planning | Abatement |
|---|---|---|---|
| New York | | | |
| 8 Dioceses | 3,292,060 Inspections and Planning | | |
| 57 Albany | | | 1,281,540 |
| 166 Brooklyn | | | 17,487,440 |
| 137 Buffalo | | | 4,860,450 |
| 321 New York | | | 13,836,480 |
| 28 Ogdensburg | | | 886,550 |
| 77 Rochester | | | 746,760 |
| 103 Rockville Centre | | | 3,487,320 |
| 64 Syracuse | | | 407,280 |
| North Carolina | | | |
| 15 Charlotte | 66,000 | 53,412 | 1,594,303 |
| North Dakota | | | |
| 20 Bismarck | 15,700 | 15,700 | 637,300 |
| 17 Fargo | 59,032 | 683,222 | 987,300 |
| Ohio | | | |
| 138 Cincinnati | 175,000 | 175,000 | 3 million |
| 182 Cleveland | 206,608 | 206,608 | 2 million |
| 63 Columbus | 43,200 | 56,800 | 4 million |
| 60 Youngstown | 32,000 | 33,000 | 5 million |
| Oklahoma | | | |
| 18 Oklahoma City | 5,614.33 | 10,426.60 | NA |
| 15 Tulsa | 36,320 | 1,800 | 300,000 |
| **Total #1481** | **2,285,504** | **2,881,998** | **60,512,723** |

| **State**<br>**# of schools** | **Inspections** | **Planning** | **Abatement** |
|---|---|---|---|
| Oregon | | | |
| 50 Portland | | | 3.5 million |
| Pennsylvania | | | |
| 69 Allentown | 71,500 | 71,500 | 350,000 |
| 54 Erie | 60,161 | 60,161 | 14,941,819 |
| 62 Greensburg | 94,739 | 18,000 | 5.5 million |
| 62 Harrisburg | 67,500 | 67,500 | 2.5. million |
| 315 Philadelphia | | | 1.3. million |
| 153 Pittsburgh | 3,176 | 1,750 | 969,150 |
| 70 Scranton | 69,200 | 30,000 | 2.8 million |
| Rhode Island | | | |
| 77 Providence | 240,000 | 273,000 | 359,000 |
| South Carolina | | | |
| 30 Charleston | 28,661 | 28,660 | 665,588 |
| South Dakota | | | |
| 32 Sioux Falls & Rapid City | | | 1,238,912 |
| Tennessee | | | |
| 22 Memphis | | | 2.6 million |
| **Total #996** | 634,937 | 550,571 | 36,724,469 |

| State<br># of Schools | Inspections | Planning | Abatement |
|---|---|---|---|
| **Texas** | | | |
| 9 Amarillo | 103,016 | 103,017 | 8,000 |
| 19 Austin | | | 2.5 million |
| 29 Corpus Christi | 62,775 | 125,550 | 750,000 |
| 35 Dallas | 50,000 | 50,000 | 6.9 million |
| 17 Forth Worth | | | 500,000 |
| **Utah** | | | |
| 12 Salt Lake City | | | 100,000 |
| **Virginia** | | | |
| 33 Arlington | 400,000 | 400,000 | 5 million |
| 35 Richmond | | | 3 million |
| **Washington** | | | |
| 62 Seattle | 50,000 | 100,000 | 13 million |
| 18 Spokane | 10,700 | 2,500 | 106,000 |
| 7 Yakima | 14,080 | 8,400 | 65,200 |
| **West Virginia** | | | |
| 40 Wheeling Charleston | 6,390.45 | 116,118.48 | 496,847 |
| **Wisconsin** | | | |
| 94 Green Bay | 86,911 | 50,833 | 865,437 |
| 86 La Crosse | 33,000 | 33,000 | 50,000 |
| 19 Superior | 30,079 | 43,643 | 790,159 |
| **Wyoming** | | | |
| 7 Cheyenne | 16,000 | 50,000 | NA |
| Total #522 | 862,951 | 1,083,061 | 34,131,643 |
| GRAND TOTAL | | | |
| #6626 | 7,051,919 | 32,034,705 | 390,782,519 |

**The National PTA**
*Office of Governmental Relations*
1201 16th Street N.W.
Washington, D.C. 20036
(202) 822-7878

Statement of
THE NATIONAL PARENT-TEACHER ASSOCIATION

Submitted to the
Committee on Environment and Public Works
Subcommittee on Toxic Substances, Environmental Oversight,
Research and Development
United States Senate

regarding
reauthorization of the
ASBESTOS SCHOOL HAZARD ABATEMENT ACT

Oral Testimony Presented by
Dolores Delaney
Member, National PTA Board of Directors

April 26, 1990

Good Afternoon. My name is Dolores Delaney. I am the immediate past president of the Virginia PTA, a state affiliate of the National PTA. I have been an active member of the National PTA for over twenty years, and currently serve as a member of the Health and Welfare Commission of the National PTA Board.

On behalf of the over 6.6 million parents, teachers, students and other child advocates who comprise the membership of the National PTA, I appreciate this opportunity to testify before your subcommittee on the problem of asbestos in schools. My oral presentation is a condensed version of the National PTA's written statement so I would ask that our complete testimony be included as part of the record of this hearing.

Since its founding in 1897, the National PTA has been concerned about a variety of health and safety issues affecting school children. Our membership has approved a strong policy in support of federal legislative and regulatory efforts to address environmental health hazards in schools, including asbestos, to ensure that adequate protections are provided for children and employees, and that proper procedures to minimize or eliminate hazards are followed.

To this end, the National PTA strongly supports S. 1893, legislation to reauthorize the Asbestos School Hazard Abatement Act (ASHAA) program. We applaud Senators Reid and Lautenberg for their foresight in introducing this legislation, and we appreciate the support of the 13 other Senators who recognize the critical need for reauthorization and have co-sponsored this important legislation.

This issue hits home with me because, during my tenure as Virginia PTA President, I was involved in an asbestos crisis in my own state that continues today. In York County, Virginia, two elementary schools were closed down for at least this current academic year when significant asbestos contamination was discovered. Over 1,200 children were displaced and thousands of dollars worth of textbooks and supplies had to be destroyed. To simply recount the events of York County's situation does not convey the unseen emotional toll the parents, teachers, and students at these schools have experienced. In addition, the county will be hard pressed to find the $500,000 they will need to abate the asbestos hazard in their schools.

I wish this were a lone example of the asbestos problem in schools, but it is not. I am not an asbestos expert, nor a scientist. I am a parent and an advocate for children. I do know that there are many schools with significant asbestos hazards and that insufficient federal funding is available to help them. I also know we must support federal legislation now in place, specifically ASHAA and the Asbestos Hazard Emergency Response Act (AHERA) if we hope to eliminate this unnecessary risk.

With this statement, I would like to review some of the facts pertinent to the issue of asbestos in schools, present the case for continued and increased funding of the ASHAA program, and respond to charges raised recently in magazine articles and editorials questioning whether asbestos abatement is a worthwhile expenditure of federal funds, or if it is even necessary at all.

## Facts about Asbestos in Schools

For decades, scientists have been studying the health effects of exposure to asbestos. There is little question that exposure to asbestos in occupational settings, at high levels, or for prolonged periods of time, poses significant risks to human health. Yet the debate about the dangers of asbestos in schools seems not to have been resolved despite the numerous studies and reports that have detailed the hazards, particularly to children. In addition, many federal agencies, including the Centers for Disease Control (CDC), the National Institute for

Occupational Safety and Health (NIOSH), the National Institutes for Health (NIH), and the Environmental Protection Agency (EPA), have reported on the harmful health effects of asbestos.

The National PTA has been involved in the policy debate about asbestos in schools from its start, and remains strongly convinced that:

- There is no known level at which exposure to asbestos is considered safe.
- 15 million children and 1.5 million school employees are exposed to friable asbestos-containing materials at more than 44,000 schools nationwide.
- Children, because of their longer remaining lifespans and higher rates of breathing, are more susceptible to the dangers posed by exposure to asbestos than are adults.

Knowing this, the National PTA cannot sit back and wait while the so-called experts prolong the debate about whether asbestos is hazardous or not. The time for study and reflection has passed. We must act now to ensure that children are no longer exposed to this environmental hazard in their schools.

## History of ASHAA:

Federal and National PTA involvement in the debate about asbestos in schools dates back over ten years. In 1979, after years of debate and study, the Environmental Protection Agency (EPA) initiated its voluntary "Technical Assistance Program" to help schools identify and abate asbestos hazards. Unfortunately, this program only helped schools that had already decided to inspect their buildings. With little guidance and no incentives, it was inevitable that school districts would not conduct voluntary inspections on their own. In 1982, after numerous delays and modifications, EPA published a final Asbestos in Schools Identification and Notification rule, which required schools to inspect their buildings and test for friable asbestos. Evaluation surveys conducted two years after the regulation was issued found high levels of noncompliance, demonstrating the ineffectiveness of the rule. As time progressed, more schools began to inspect, but again, there was insufficient guidance from the federal government, and schools found it difficult to find accredited or qualified trained personnel who could inspect and complete the necessary abatement work. Throughout this time, the National PTA sought more stringent procedures as it became apparent that voluntary measures were not going to succeed.

In 1980, Congress first acknowledged the federal responsibility to assist financially strapped school districts with the costs of clean-up by enacting P.L. 96-270, a loan and grant program designed to help schools detect and abate hazardous asbestos. The law was administered by the Department of Education, but never received funding. At congressional hearings on the subject held in 1984, a number of educational groups, including the National PTA, testified about the severe financial burdens schools faced in attempting to eliminate the asbestos hazard from schools, and about the lack of funding for the Department of Education program.

In June, 1984, with broad, bipartisan support--led by the Senators on this Committee--Congress approved the ASHAA legislation, which transferred the loan and grant program to the EPA. The ASHAA process requires that local education agencies (LEAs) submit applications for funds to their state's governor. The governors verify the financial need of the LEAs and then rank the applications according to the severity of the asbestos hazards described in the applications. EPA awards the funds based on a combination of the two factors--financial need and degree of hazard posed by the asbestos. Applications from financially eligible schools are given a priority rank based on the degree of damaged friable asbestos they have, with "Priority One" signifying the most damaged materials. The ASHAA program provides interest-free loans to LEAs for up to 100 percent of the cost of a school's hazard abatement and/or grants to LEAs for up to 50 percent of the abatement costs.

## Need for ASHAA Reauthorization

In creating the ASHAA program within the EPA, Congress acknowledged that an attempt to manage asbestos in America's schools was going to require federal assistance. However, there have been annual struggles to secure funding for this program. In 1984 Congress appropriated the $50 million that was authorized for the first year. Since then the appropriations levels have been well under the authorization ceilings; the law authorized $700 million over a seven year period, but so far schools have received only about $203 million. An additional $45 million has been spent during these years on related activities, such as worker training and certification, loan management, program administration and technical assistance to states. For the current fiscal year, 1990, the authorization ceiling is $125 million and $44.7 million will be available for schools.

The Administration has never requested funding for this program. In the 1991 budget, the President again proposed elimination of the program stating "the worst threats and neediest schools are currently being addressed." The Administration further defended its position in reporting, "by 1991, all schools should be well along in implementing their asbestos management plans."

According to EPA, as of October 1989, 94 percent of all school districts had completed the asbestos management plans required by the Asbestos Hazard Emergency Response Act (AHERA) enacted in 1986. National PTA believes the need for ASHAA funds will increase this year, if anything, because by July of 1989, all schools should have actually begun the necessary abatement work. The National PTA believes firmly that continued and increased federal financial assistance is needed for the ASHAA program.

The latest data from EPA show that for the fifth consecutive year, the amount of money requested through ASHAA has increased. In the 1990 application cycle, LEAs have requested almost $406 million for abatement activities, but the $44.7 million available will only be enough to fund about 11 percent of the costs of these projects. Overall, only about 16 percent of the schools applying for ASHAA funds have received awards. Even among those projects that have been categorized as Priority One--the most hazardous, less than one-third have been funded.

S. 1893 extends the authorization for the loan and grant program through FY 1995 and increases the maximum amount that could be appropriated to $250 million per year. The new legislation would improve the program in a number of ways. It increases the authorization ceilings, strengthens the administration of the application and award processes to avoid unnecessary delays, and requires that applicants be implementing their management plans according to AHERA. The National PTA is interested in reviewing the financial need criteria used by EPA to determine a school district's eligibility, and in recommending possible changes to the formula.

As in current law, S. 1893 would set aside certain funds for worker training and certification, an important aspect of the overall asbestos management program. While we are disappointed that insufficient funding has been available for actual loans and grants to schools, we do not want to see funds targeted for certification and training cut either.

The ASHAA totals--both for actual loans and grants and for related activities--are abysmally low. The EPA itself has estimated that the schools' cost of compliance with AHERA is over $3 billion. The National School Boards Association (NSBA), in a survey of its members on this issue, has estimated that cost to be closer to $6 billion. So far, the total amount provided to schools through ASHAA represents only six percent of even the lower EPA estimate.

## National PTA Support for AHERA

While the primary purpose of this testimony has been to highlight the serious need for renewal of the ASHAA program, I also want to take this opportunity to respond to charges made in magazine articles and newspaper editorials alleging that the public and the federal government have overreacted to the problem of asbestos in schools.

The article that seems to have had the greatest impact is one published in the January 19, 1990 issue of Science. The article leaves readers with two major misconceptions about the asbestos problem. The first concerns unnecessary asbestos removal. The Asbestos Hazard Emergency Response Act, known as AHERA, **does not require removal of asbestos**. The purpose of AHERA was to create a comprehensive, standardized plan for managing the asbestos problem in our nation's schools, not to require removal of asbestos. AHERA requires an initial inspection of schools to determine if asbestos is present, and regular surveillance to detect if damage or deterioration of asbestos has occurred. In properly managing asbestos, schools must develop management plans that provide for monitoring the asbestos to ensure that it remains in good condition. If damaged asbestos is found, schools must repair the damage, encapsulate or enclose the damaged materials, and in rare instances remove the asbestos, using special procedures. More importantly, AHERA requires that all of this work be performed by trained, experienced, EPA-accredited professionals.

AHERA was enacted in 1986 in response to a critical need to establish safeguards and guidelines for a process that was out of control. Prior to AHERA, many schools were already proceeding with asbestos abatement work. However, they were at the mercy of unqualified personnel who increased the health risks by performing inferior work, or by undertaking unnecessary removal projects. In 1985, the EPA estimated that 75 percent of asbestos abatement work was being done improperly. Today, over 94 percent of the nation's schools have completed asbestos inspections and developed management plans, bringing them closer to the goal of reducing children and school employees' risk of exposure to hazardous asbestos in schools.

The second oft-repeated misconception is that low-level exposure to the type of asbestos predominantly found in schools in this country--chrysotile asbestos--poses relatively low risk compared to other types of asbestos. This same issue was raised back in 1984, and debated at hearings on the subject before this same subcommittee. Then-Chairman, former Senator Robert Stafford (R-VT), and fellow-Committee-member, former Senator James Abdnor

(R-SD), asked the Director of the Center for Environmental Health at the Centers for Disease Control (CDC) for his views on the health effects of chrysotile asbestos.

In response to the Senators' request, the CDC prepared a statement on chrysotile asbestos and disease. The statement concludes that chrysotile asbestos is carcinogenic and that this position is supported by extensive scientific studies on both animals and humans. In congressional testimony presented in 1983, the Department of Health and Human Services' Public Health Service representative, Dr. Vernon N. Houk, stated that "the hazards of chrysotile asbestos have been established as medical fact and that there is no good basis for debate to the contrary."

Others who attempt to minimize the risk to the general population offer that asbestos is only harmful to workers who are exposed, in occupational settings, to high levels of asbestos over long periods of time. However, in a recent study of public school custodians in Boston, Dr. Christine Oliver of Harvard Medical School found an unusually high rate of lung scarring among these workers whose only exposure to asbestos was during their long tenures in the schools. At Mt. Sinai School of Medicine, a recent examination of school custodial workers yielded similar results.

Numerous reports on the hazards of asbestos have been issued over the past decade. But even very recently, in July, 1989, the EPA issued a final rule to ban all uses of asbestos. After three years of analysis and study, and review of 45,000 ages of comments just on the proposed rule, EPA reported that, "It is well-recognized that asbestos is a human carcinogen and is one of the most hazardous substances to which humans are exposed in occupational and non-occupational settings" (emphasis added). Further, the EPA states, "the conclusions [reached by the EPA] regarding the health effects of asbestos exposure represent a widely accepted consensus of opinion of health agencies, scientific organizations, and independent experts." The data presented to Congress by the EPA and leaders in the scientific community clearly demonstrate that there is no known safe level of exposure to asbestos.

Knowing this, why would any of us allow our children to remain in classrooms or school buildings that have friable asbestos-containing material while the experts conclusively decide at what level the exposure becomes hazardous? The National PTA is not willing to stand back and wait as school children "test" the level of risk of asbestos in their classrooms.

## Conclusion

We must act responsibly. EPA estimates that over 44,000 school buildings may have friable asbestos problems. The federal government must renew its commitment to eliminate the hazard posed by asbestos in schools to the 15 million school children and 1.5 million school employees exposed to the harmful substance every day. We understand that asbestos abatement can be expensive. However, concerns about cost should not relieve us of our responsibility to provide safe and healthful classroom environments for school children. Increased federal funding for ASHAA is critical to assure that school districts are not forced to postpone the purchase of needed educational supplies or materials in order to fund asbestos abatement projects.

After reading this statement it becomes evident that the National PTA is extremely concerned about this issue and remains convinced that asbestos in schools is a national crisis warranting increased federal involvement. The National PTA vigorously opposes repeal of AHERA, and strongly urges Congress to reauthorize ASHAA and provide significant funding increases for the loan and grant program.

In concluding, just for the sake of this testimony, let us accept for a moment the contention that low-level exposure to asbestos does not pose a risk to children and employees in schools. This reasoning does not contradict support for either AHERA or ASHAA. In fact, accepting this argument strengthens the need for both measures. It seems we would at least want to ensure that asbestos exposure remains at low levels. In order to do this, we would hire qualified personnel to test if we had high levels of asbestos, reduce high levels if found, periodically inspect for changes in the condition of non-damaged asbestos-containing materials, and abate asbestos that had been damaged. In other words, we would follow provisions similar to those outlined in AHERA. Similarly, we would not oppose ASHAA because ASHAA simply provides funding to school districts for abatement of asbestos hazards that have already been determined to be very dangerous.

Again, thank you for this opportunity to comment on S. 1893. I would be happy to respond to questions you have concerning our position on this issue.

AFSCME®
**American Federation of State, County and Municipal Employees, AFL-CIO**
1625 L Street, N.W., Washington, D.C. 20036
Telephone (202) 429-1000
Telex 89-2376
Facsimile (202) 429-1293
TDD (202) 659-0446

Gerald W. McEntee
*President*

William Lucy
*Secretary Treasurer*

*Vice Presidents*

Ronald C. Alexander
*Columbus, Ohio*

Dominic J. Badolato
*New Britain, Conn.*

Joseph Bolt
*Richmond, Ind.*

Joseph M. Bonavita
*Boston, Mass.*

George Boncoraglio
*New York, N.Y.*

Robert A. Brindza
*Columbus, Ohio*

Stephen M. Culen
*Chicago, Ill.*

Albert A. Diop
*New York, N.Y.*

Danny Donohue
*Albany, N.Y.*

Anthony M. Gingello
*Rochester, N.Y.*

James Glass
*Lansing, Mich.*

Stanley W. Hill
*New York, N.Y.*

Blondie P. Jordan
*Orlando, Fla.*

Edward J. Keller
*Harrisburg, Pa.*

Joseph J. Kreuser
*Menomonee Falls, Wisc.*

Faye D. Krohn
*Kasota, Minn.*

Marilyn LeClaire
*Columbiaville, Mich.*

Joseph E. McDermott
*Albany, N.Y.*

Donald G. McKee
*Des Moines, Iowa*

Jack Merkel
*Trenton, N.J.*

Gary Moore
*Olympia, Wash.*

Henry Nicholas
*Philadelphia, Pa.*

Russell K. Okata
*Honolulu, Hawaii*

George E. Popyack
*Belmont, Calif.*

Thomas A. Rapanotti
*Baltimore, Md.*

Joseph P. Rugola
*Columbus, Ohio*

Kathy J. Sackman
*Pomona, Calif.*

Burhman D. Smith
*Philadelphia, Pa.*

Linda Chavez-Thompson
*San Antonio, Tex.*

Garland W. Webb
*Baton Rouge, La.*

# STATEMENT OF THE

# AMERICAN FEDERATION OF STATE, COUNTY AND MUNICIPAL EMPLOYEES

# ON

# THE ASBESTOS HAZARD EMERGENCY RESPONSE ACT

# BEFORE THE

# SUBCOMMITTEE ON TOXIC SUBSTANCES, ENVIRONMENTAL OVERSIGHT, RESEARCH AND DEVELOPMENT
# COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS
# UNITED STATES SENATE

APRIL 26, 1990

This statement is submitted on behalf of the American Federation of State, County and Municipal Employees (AFSCME). This coming weekend, labor unions across this country will be observing Workers Memorial Day, a day to commemorate working people who have died on the job. On April 28th, events will be held under the theme of "Mourn for the Dead, Fight for the Living."

Today we would like to address only one hazard, asbestos. Asbestos has already taken the lives of hundreds of thousands of workers. It is a substance that is estimated to take another ten thousand lives per year until the end of the century. Our remarks will be confined to a discussion of asbestos in this nation's primary and secondary schools.

Nationally, AFSCME's 1.2 million members work in a wide range of job classifications primarily in state and local government, hospitals, and non-profit organizations. AFSCME represents school employees across the country, and many thousands more custodial and maintenance workers in non-school buildings. The majority of AFSCME members work in buildings which contain asbestos. Union members and retirees have died or become seriously ill as the result of their exposure to asbestos in schools and other buildings.

At the outset, we must emphasize that the Asbestos Hazard

Emergency Response Act (AHERA) is an important law which is necessary to protect school populations from the deadly hazards of asbestos. Unfortunately, too many schools throughout the country have done a very poor job of implementing AHERA's requirements. However, despite shortcomings in implementation, it would be wrong to conclude that AHERA was a bad idea.

The task before all those concerned about safeguarding the health of school children and workers is how to improve the effectiveness of AHERA. We have included as part of our statement a study recently conducted by AFSCME's Research Department which documents a dismal record of compliance with AHERA by Ohio schools. In all probability, Ohio is not unique in this respect. In the Union's experience, the single most important factor hindering the full implementation of AHERA is the schools' lack of funds to address asbestos problems. Congress must appropriate sufficient funds so that schools have the resources they need to initiate measures which are essential to protect school children and employees from asbestos. Full funding of the asbestos in schools program can do more to guarantee protection from asbestos than any other single factor.

AHERA was passed unanimously because Congress found that the Environmental Protection Agency's (EPA) 1982 school inspection rule was woefully inadequate. AFSCME supported the passage of AHERA, and was also a member of the negotiating committee which developed the EPA asbestos in schools regulation. The AHERA model of addressing asbestos hazards is sound. AHERA requires that local education authorities (LEAs) inspect primary and secondary school buildings for asbestos; identify the need for responses to asbestos; describe appropriate response actions; establish procedures for ongoing surveillance of asbestos-containing materials (ACM); establish an operations and maintenance (O&M) program; and implement other measures necessary for proper asbestos management.

The adverse health effects of asbestos have been clearly and repeatedly established. In the preamble to its 1986 asbestos regulation, the Occupational Safety and Health Administration (OSHA) stated that "OSHA is aware of no instance in which exposure to a toxic substance has more clearly demonstrated detrimental health effects in humans than has asbestos exposure." Asbestos is a potent carcinogen that causes mesothelioma, lung, esophagal, stomach, colo-rectal, kidney, and laryngeal cancers. Asbestosis is the scarring of lung tissue caused by the accumulation of asbestos fibers in the lungs, causing death or severe disability. The scarring may be within the lungs, or on their surface (pleura), or both.

Thousands of workers will continue to die of asbestos-related diseases through the rest of this century from the exposure they received over their working years. However, the death and disease will not be confined to workers who encountered their exposures in the manufacture and installation of asbestos products. A new epidemic is emerging among those who have been exposed to asbestos fibers which have been released from asbestos-containing materials already placed in buildings, and the population at risk includes workers and other building occupants.

A concerted effort to identify those who have been adversely affected by exposure in buildings has only recently begun. Doctors Stephen Levin of Mount Sinai and Christine Oliver of the Harvard Medical School presented alarming testimony before another Congressional committee in early April. Doctors Levin and Oliver conducted examinations of custodians in New York and Boston and found asbestos-related disease in as high as 40 percent of long term employees. The death and disease are primarily the result of routine exposure to asbestos, not large asbestos removal projects. Routine exposure occurs day after day, year after year, and is the result of custodial or maintenance tasks in which disturbances of asbestos materials are not controlled. AFSCME will be conducting additional screenings in the near future, and unfortunately, there is no reason to believe that the findings of Doctors Levin and Oliver will not be replicated.

Asbestos is also a risk to other building occupants. AHERA was passed in large part to protect school children from exposure. Although there is controversy over the significance of the hazard that asbestos poses to building occupants, there is general agreement that the risk increases with exposure. The literature on asbestos-related health effects on building occupants is practically non-existent. Conducting investigations of occupants would require a very large study population and would be costly. However, it would be poor public health policy to assume that the absence of studies means an absence of risk, or that the failure to look for asbestos disease among building occupants means there are no victims.

Given recent findings of disease among custodians and other maintenance workers, it would be illogical to assume that no other occupants have or will be affected. Granted, exposures of building service workers are higher than for other occupants. However, many custodial and maintenance tasks occur in areas which are inhabited by other people, including students. If asbestos control measures are not in place, workers cause contamination to themselves and others. Due to the physical characteristics of asbestos, fibers which are released can be circulated throughout the building by the ventilation system, exposing building occupants to asbestos.

Recently, parties interested in limiting their liability due to asbestos, have intensified their public relations efforts to downplay the risks of asbestos. They employ spurious science to bolster their claims that fear about exposure in buildings is exaggerated, and the real problem is "fiberphobia", rather than the asbestos. It is an unconscionable effort to portray asbestos in buildings as virtually harmless, and better off left alone.

One particular party you will hear from in this discussion is the Safe Buildings Alliance (SBA). There is nothing safe or benign about this organization. SBA is comprised of former manufacturers of asbestos products. Asbestos companies and SBA have resisted all attempts to regulate asbestos and otherwise protect the public from their deadly products. SBA was a member of the negotiating committee that wrote the asbestos in schools regulation. SBA subsequently challenged the AHERA rule all the way to the U.S. Supreme Court and lost. Needless to say, the financial interests in the asbestos debate are already very high. As the stakes grow higher, the claims and tactics of organizations such as SBA become ever more outrageous.

The debate over the risks of asbestos in buildings and what measures are needed to address those risks escalated with the appearance of an article by Mossman et al. in Science in January of this year. The authors of this article assert that chrysotile asbestos, the most common form of asbestos, is less toxic than other asbestos forms. Instead of addressing this issue in our testimony, we have attached an article written by Dr. William

Nicholson of the Mount Sinai School of Medicine which refutes the findings of Mossman et al. Further, EPA Assistant Administrator for Pesticides and Toxic Substances, Linda Fisher, testified before the House Committee on Education and Labor Subcommittee on Health and Safety in early April, and stated:

> "Asbestos is known to cause cancer and other disease if fibers are inhaled into the lung and remain there, based upon studies involving human exposure and particularly at high levels. While evidence is better for some types of asbestos, there is no clear proof that other types are not as potent."

Of greater concern are the outrageous, misleading, and dangerous conclusions contained in the article's discussion of public policy. Mossman et al assert that asbestos in buildings is not an important risk factor. They argue that the mere discovery of asbestos in buildings creates panic, and a great deal of haphazard asbestos removals have been conducted which expose the abatement workers. The article concludes that the aim of public policy should be to curtail the so-called asbestos panic in this country in order to protect young removal workers who may develop asbestos-related cancers in later decades.

No reputable scientific body, nor governmental agency such as OSHA or EPA has ever determined there is a safe threshold of exposure to asbestos, and all asbestos fibers produce adverse health effects. There is consensus among all those who are knowledgeable and reputable regarding asbestos issues that asbestos exposure should be prevented, and certain measures are necessary to accomplish this objective in buildings which contain asbestos. The investigations of Doctors Levin, Oliver, and others clearly demonstrate that asbestos in buildings is a risk to human health, and not just asbestos removal workers. And in buildings where asbestos has not been identified and/or appropriate steps have not been taken to prevent exposure, the presence of asbestos poses a significant and unreasonable risk to workers and occupants.

AHERA is different and better than other asbestos laws because it recognizes that it is not possible to base policy toward asbestos in buildings on air measurements of asbestos. Once asbestos is in the air, you have lost the battle to prevent exposure. To avoid exposure, a preventive approach is necessary. A preventive approach must be triggered by the presence of asbestos in a building, rather than air concentrations of asbestos. This entails finding asbestos, and taking measures ranging from management to removal of asbestos, to ensure that uncontrolled disturbance does not occur.

By contrast, parties who claim the risks of asbestos in buildings are minimal, base their claims in part on questionable assumptions about ambient asbestos levels under so-called normal conditions. The air monitoring studies of buildings which have been cited are no reason for comfort or complacency. Air samples taken at a time when nothing is occurring in the building do not provide any information about exposures that result after building materials or asbestos debris are disturbed and release fibers into the air.

Air monitoring studies of repair and maintenance jobs have repeatedly demonstrated that peak exposures do occur, and above existing permissible exposure levels. When asbestos is disturbed, it does not harmlessly dissipate or disappear. When an unprotected worker goes above a drop ceiling, pulls off pipe insulation, or sweeps asbestos dust, some of those fibers are not going to be measured because they are in the lungs of the worker and any bystanders who happen to be around.

Unlike other asbestos regulations, AHERA requires that asbestos be identified, and an assessment be conducted of the present and potential hazard posed by the material. This information is critical in order to choose appropriate response options. These alternatives range from managing material in place to removal, or a combination of these strategies. Asbestos removal which is properly conducted, represents the only permanent solution for preventing exposure to asbestos. Asbestos removal can be accomplished without causing exposure to removal workers, or contaminating areas outside the work site.

Unfortunately, there are unscrupulous and/or incompetent removal contractors engaged in asbestos removal and other abatement activities. Parties interested in limiting their liability for the costs of asbestos removal have pointed to the existence of unqualified companies as a reason to conclude that asbestos removal causes unacceptable exposure to asbestos, and therefore removal should be avoided wherever possible. Avoiding or discouraging removal is not the answer. Instead, requirements for training and work practices for asbestos removal should be more stringent and vigorously enforced.

The alternative to asbestos removal is managing the material in place. As an option allowed by AHERA, schools have relied heavily on managing asbestos in place to prevent exposure. The decision to manage asbestos in place requires an ongoing program of actions which are necessary to prevent the release of asbestos fibers, potentially for decades. Proper management of asbestos is much easier said than done, and is not necessarily an inexpensive alternative.

The cost of repair and encapsulation operations approaches that of removal in part because regulated areas must be established the same as for removal work, and these expenses reoccur with removal. The cost to properly conduct operations and maintenance activities in a building can also be substantial. The expenses include training for building service workers and providing respirators. The use of respirators requires a medical surveillance program, fit testing, and other elements of a required respiratory protection program. Equipment must be available for planned activities which disturb asbestos, to respond to unanticipated events that damage asbestos materials, and to conduct routine custodial tasks in areas that contain asbestos materials.

All options to adequately respond to the presence of asbestos in schools and other buildings cost money. Schools need financial assistance regardless of whether asbestos must be removed or managed in place. To the extent possible, society should impose the costs of preventing exposure and compensating its victims on those who have created the hazard. In the meantime, that help must come from the federal government.

We conclude this portion of AFSCME's testimony by remarking that we are not satisfied with the situation in which the school employees we represent have better protection from asbestos than our members who work in non-school settings. Asbestos is no less of a hazard to human health in other buildings. We are concerned that AHERA is the only federal regulation that requires that asbestos in buildings be identified and assessed for the current and potential hazard posed by the material. To remedy this situation, AFSCME is currently involved in a lawsuit against the Environmental Protection Agency (EPA) to force the Agency to initiate a rulemaking that would require asbestos inspections of all public and commercial buildings, and require appropriate responses where asbestos is found.

We will now discuss the results of the survey AFSCME conducted concerning compliance with AHERA by Ohio schools, which we mentioned previously.

In October 1989, EPA announced that ninety-four percent of the nation's public school districts and private schools had inspected school buildings and submitted management plans by dates required in AHERA. The quality of inspections and management plans has not yet been evaluated. It is apparent, however, that many schools have not implemented the plans. Local unions in Ohio and across the country have contacted AFSCME headquarters for assistance where local education authorities have not taken steps necessary to protect their health.

AFSCME initiated a study to determine whether schools had implemented important elements of their management plans, as AHERA required by July 9, 1989. To answer this question, the investigation focused on the extent to which schools had complied with notification, training, and work practice requirements specified in the EPA Asbestos-Containing Materials in Schools

Final Rule. Approximately four-hundred and fifty custodians and maintenance employees who work in schools which contain asbestos provided information regarding asbestos management practices in Ohio school districts of varying sizes throughout the state. The findings in this report clearly show that schools have not implemented basic AHERA requirements necessary to prevent asbestos exposure for workers, students, or other occupants.

The first issue examined was whether custodians and maintenance staff had been informed of the locations of asbestos in the buildings they work. Schools must provide all custodians and maintenance workers with awareness training which informs them of the locations of asbestos in each school building. Schools are also required to post warning signs in routine maintenance areas such as boiler rooms.

Eighty-four percent of respondents reported that they have received the mandatory asbestos awareness training. However, it appears that the training did not accomplish one of its principle objectives: Only seventy-three percent of those who received training answered they had been told where all asbestos is located. As for additional notification requirements, only forty-one percent of the school districts have complied with all of the following: informing staff of the locations of ACM, providing awareness training, and posting warning signs.

The next area investigated in this study concerns respiratory protection for school personnel. According to responses of building service workers concerning their work assignments, schools have not provided appropriate respiratory protection to their employees. Only thirty-four percent of workers expected to respond to minor and major disturbances of asbestos have been issued respirators. Compounding the problem, schools not only failed to issue respirators where necessary, but did not follow the most basic elements of a required respiratory protection program. Only thirty-two percent of those who had received a respirator responded that they were the only one who used the respirator, had been given a physical exam before receiving the respirator, and had received a fit test.

The survey also examined the availability of another type of protective equipment, vacuums with High-Efficiency Particulate Air Filters (HEPA). Ordinary vacuum cleaners do not filter out asbestos fibers; they merely recirculate the fibers back into the air. HEPA-vacuums should be used in cleaning operations involving asbestos, and during maintenance activities such as glove bag operations used to repair asbestos-containing thermal pipe insulation. Only twenty percent of respondents reported that a HEPA-vacuum was available in their school(s) for performing glove bag operations or cleaning.

The study examined the extent to which appropriate work practices were being followed in the schools. AHERA distinguishes between activities which disturb small amounts of asbestos versus larger disturbances of ACM. For example, a minor fiber release episode is the falling or dislodging of less than three linear or square feet of asbestos, while a major release involves more than three linear or square feet. The AHERA regulation also specifies work practices for small scale, short duration (SSSD) operations and maintenance and repair activities involving asbestos.

Examples of SSSD activities include repair of pipe insulation which can be contained in one glove bag, replacement of an asbestos-containing gasket or valve, or minor repairs to asbestos-containing wallboard. In all these cases, repair and clean up must be performed by those with a minimum of two days of training, who use specified work practices, and are wearing respiratory protection. Only thirty percent of the custodians and maintenance workers expected to clean up small amounts of asbestos have been properly trained and have been issued respirators. Further analysis shows that custodians get less training and equipment to properly conduct small clean up and repairs than do maintenance workers.

From the responses of our members, AFSCME learned that schools have complied less frequently with AHERA requirements for major release episodes than for smaller incidents. Responses to major fiber release episodes must be conducted by accredited workers who have received a minimum of three days training. Only thirteen percent of custodians and maintenance workers who are expected to clean up more than three feet of asbestos have been properly trained and have been issued a respirator. Once again, custodians have received less training and equipment than maintenance staff.

Appendix B of the AHERA regulation describes certain activities which are prohibited where asbestos-containing materials are involved. Examples of these activities include: dusting or sweeping surfaces contaminated with asbestos, sanding floor tiles, removing or shaking dry ventilation filters, using ordinary vacuum cleaners to clean up asbestos debris, and removing ceiling tiles below areas which contain asbestos without wearing a respirator and clearing the area of other occupants. Unfortunately, the results of our study show that many of our members are expected to perform these activities.

Schools were required to use special cleaning methods such as wet-cleaning or HEPA-vacuuming in all areas of a school building containing friable asbestos or suspected asbestos after the completion of the inspection and before the beginning of response actions other than activities considered to be operations and maintenance. The purpose of these procedures is to clean up asbestos fibers which have been previously released.

Only twenty-six percent of respondents reported that the special cleanings had been performed.

This study did not attempt to evaluate whether necessary abatement actions had been taken, or the quality of such activities. However, respondents were asked whether they had been engaged in abatement jobs (removal, encapsulation, enclosure, or repair) involving large amounts of asbestos. AHERA requires accredited personnel (a minimum of 3 days of training) to conduct these activities. Only twenty-one percent of custodians and maintenance workers engaged in asbestos abatement have received proper training and have been issued a respirator.

The last issue examined in this study concerns exposure monitoring requirements for activities involving disturbance of asbestos. Exposures must be measured from representative breathing zone air samples. Monitoring must also be performed unless an employer already has data on employee exposures collected during similar operations. Schools have virtually ignored the exposure monitoring requirements: Only four respondents in the entire survey reported ever having worn an air sampling pump.

The survey responses of school custodians and maintenance workers clearly indicate that LEAs are not adequately preventing asbestos exposure to workers and students. Based on all criteria used, either a majority or substantial portion of schools have not complied with AHERA by satisfactorily implementing their management plans.

AHERA did not require LEAs to remove all asbestos in schools. As a result, there has been a heavy reliance upon managing asbestos in place as the response action chosen to prevent asbestos exposure. While this is legal, certain procedures must be followed to prevent uncontrolled disturbances of asbestos. Based upon the indicators used in this study, however, schools are doing a poor job of managing asbestos in place. The failure of LEAs to properly manage asbestos has therefore subjected workers and students to unreasonable levels of asbestos exposure, and continues to do so. This poor record of compliance can probably be explained in large part by the following factors:

First, asbestos management is often a relatively expensive activity for schools. Removal and other abatement costs can be prohibitive. Most schools have had to establish priorities for areas requiring abatement actions versus those areas where managing asbestos in place through an operations and maintenance program is permitted. However, properly managing material in place is also costly, and these expenses often compete with other needs of school district budgets. In all cases where compliance has been a significant problem, local school authorities have cited a shortage of funds as the main reason that they have not or cannot implement particular AHERA requirements.

Unfortunately, Congress did not authorize sufficient funds to help schools address asbestos problems as required in AHERA. Schools have had varying degrees of success in channeling existing funds to asbestos management or finding new sources of revenue. This has not been easy in a climate when schools have come under increasing public pressure to improve their performance in providing quality education.

Second, local school authorities often lack an understanding of AHERA and fail to appreciate the risks of asbestos. AHERA allows LEAs to use their own employees to perform asbestos management responsibilities. However, these individuals have not always received sufficient training to carry out these functions. For some school officials, AHERA implementation has been added to their other full time duties. They have neither the time or knowledge to ensure compliance on behalf of their school districts.

School officials have also failed to appreciate the health risks of asbestos exposure. The lack of knowledge contributes to a casual attitude about ensuring that the health protective measures of AHERA are followed. For most schools, AHERA represents a sharp departure from traditional work practices involving asbestos. Complacency is reinforced by the long latency period of asbestos-related diseases. Inappropriate attitudes of management toward asbestos have a direct bearing on the attitudes and behavior of all school employees. Unless building service workers receive effective training, have appropriate equipment, and detect a sense of urgency concerning asbestos management, it is unlikely that custodians and maintenance employees will have a sufficient appreciation of asbestos dangers and the need to carefully follow procedures which are necessary to protect themselves and others.

Third, EPA is responsible for enforcement of AHERA unless it has granted a waiver to a state to take over enforcement functions. AHERA granted EPA many enforcement tools. Under AHERA, EPA may inspect schools and impose substantial fines and other penalties. The Agency may assess criminal penalties for willful violations, and also obtain injunctive relief to respond to hazards which pose an imminent danger to human health. Unfortunately, the enforcement resources of EPA are limited, and EPA has not vigorously enforced AHERA. Schools are highly unlikely to be inspected by EPA. It does not appear that the threat of EPA enforcement action has had a substantial deterrent effect on LEAs who violate AHERA.

Although there have been problems with implementation, SCHOOLS HAVE CLEARLY, AND SUBSTANTIALLY IMPROVED THEIR EFFORTS TO

**ADDRESS ASBESTOS SINCE THE PASSAGE OF AHERA. AHERA is the type of model which is needed for other buildings. If asbestos management in schools is this poor despite relatively stringent regulation, the situation is certain to be more dangerous in buildings where there are no equivalent laws.**

In conclusion, the time is long overdue for the Federal government to recognize its obligations to protect the health of its citizens and mandate measures to address this extremely serious public health problem. Building owners in the private and public sector have not initiated steps on their own to effectively control asbestos. Workers have already paid dearly for the failure to address the hazards of asbestos in buildings. They have paid with their lives and good health. Preventive actions today can reduce the number of future victims.

A bold program is necessary to prevent asbestos exposure that results from dangerous removals or inadequate management programs. It is not feasible to immediately rid all buildings of asbestos, but there are actions which should be mandated. Federal regulations are necessary to require inspection of buildings. Identification of asbestos materials is the first step in any program designed to prevent exposure. Additional regulations are necessary to require appropriate response actions where asbestos is found. Training and work practice requirements for asbestos removal and management must be improved and effectively enforced.

We appreciate this opportunity to submit this statement to the Subcommittee.

April 20, 1990

Sylvia Batties
923 East Third Street, Suite 305/405
Los Angeles, Ca 90013
(213) 620-8551

Professional Staff Member Stephanie Clough,
Senator Harry Reeds Office, Environment and Public Works Committee

RE: EPA's Assessment of Asbestos Exposure in Public Buildings.

Dear Ms. Clough:

This letter is being sent in the hopes that it will become a part of public record, and that in someway it will assist in the decision to extend the EPA's Asbestos-in-Schools Rule to Public and Commercial buildings.

## FACTS

The EPA's May 1988 Final Report, Assessing Asbestos Exposure in Public Buildings, failed to include or consider in their field study the following:

- Asbestos paper, commonly used as fireproofing between the wood flooring in 1900 Public and Commercial buildings.
- Asbestos containing paper has Chrysotile asbestos content as high as 85%.
- Twenty-Four hour exposure to occupants, i.e., tenants, children, clients, workers and the general public in renovated Artist-in-Residence lofts buildings.
- Sandblasting of the interior to remove old paint, a common practice, which results in extreme damage to the asbestos paper and the release of friable asbestos materials at and around the facility.
- Cutting, drilling, tearing, hammering, etc. of the asbestos paper occurs during conversion process and additional renovation by the tenants, further discharging asbestos fibers.
- Because of the location of the asbestos paper between the flooring of these buildings, occupants in the course of their daily activities will disturb the asbestos paper and elevate asbestos fiber levels in the air.

## BACKGROUND

The presence of asbestos containing paper, in old buildings that has deteriorated, or is further damaged during the renovation process, i.e., sandblasting of interiors to remove old paint, has been overlooked by all EPA studies. Old buildings are being converted to Artist-in-Residence lofts at a rapid pace, all across the United States. The damaged condition of asbestos containing paper after renovation, its location, and the probability of significant disturbance, and subsequent fiber release, can be concluded that these buildings will pose a significant health risk to its occupants and the public, unless strick rules and regulations are applied, and enforced.

A case in point is an existing structure at 923 East Third Street in Los Angeles, California. The owners renovated and converted the subject property from a warehouse into Artist-in-Residence lofts. During the renovation the interiors were sandblasted to remove old paint, even though the the presence of asbestos paper was documented in the original building permits issued for the structure in 1909. (I) Sylvia Batties and Robert Chillis lease one of the Artist-in-Residence lofts, where we live and conduct a design business.

Tenants of the subject property were not warned of the presence of asbestos containing paper, or that asbestos fibers were present in the air. Once we took possession of the suits we, as well as, other tenants made additional improvements with the owners express consent. This construction resulted in further asbestos exposure, not only to us, our clients and friends, but also in unknowing exposure to our workmen.

Tenants complained to the owners about a considerable dust problem for an extended length of time (approx. 1 1/2 yrs.). The dust was present in thick layers and could been seen in the air. The owners denied any knowledge of a problem. July 3, 1989 tenants had the suspected insulation material tested, it was found to contain 40-60% Chrysotile asbestos and concluded to be potencially hazardous.

Following the tenants testing of the asbestos containing paper the owners retained an Environmental consult, who recommended implementation of a comprehensive asbestos management program which included remediation. Despite the fact that the EPA clearly states that friable asbestos must not be encapsulated, the owners conducted encapsulation and spot removal in the building. The encapsulant did not penetrate the asbestos paper, the weight of the encapsulant, activities such as walking, normal building movement and vibration has caused continued stress on the asbestos paper causing it to become detached, which leaves frayed edges which are not protected by the encapsulant material and are therefore sites where asbestos fiber release can occur, particularly at the time that the paper is tearing, thus creating an ongoing toxic hazard.

Numerous government agencies were notified of the ongoing hazardous conditions of the subject property, and could not/or failed to enact any abatement enforcement.

## CONCLUSION

There is a dire need to establish standards for, and regulate the asbestos exposure in Public and Commercial buildings, especially those building inwhich the occupants live, as well as work. There needs to be a lead agency desiginated for enforcement and all occupants must be warned of the presence of asbestos, especially when they undertake additional renovation operations.

Some, if not all of the Asbestos Hazard Abatement Act (AHERA) standards should be extended to public and commercial buildings, in light of the fact that children often live in these buildings.

Sincerely yours,

Sylvia M. Batties

Sylvia M. Batties

cc. Council Judy Lamson
Transportation & Hazardous Materials Sub Committee
U.S. House of Representatives

# STATEMENT FOR THE RECORD

BY THE
BUILDING OWNERS AND MANAGERS ASSOCIATION (BOMA) INTERNATIONAL

FOR THE
SENATE ENVIRONMENT AND PUBLIC WORKS SUBCOMMITTEE
ON TOXIC SUBSTANCES, ENVIRONMENTAL OVERSIGHT,
RESEARCH AND DEVELOPMENT

HEARING ON ISSUES ASSOCIATED WITH ASBESTOS REMOVAL
APRIL 26, 1990

BUILDING OWNERS AND MANAGERS ASSOCIATION INTERNATIONAL
1201 NEW YORK AVENUE, N.W., WASHINGTON, D.C. 20005 (202) 408-2684

The Building Owners and Managers Association (BOMA) International is a national trade association representing more than 7,200 building owners and managers.

The issue of asbestos tops BOMA's list of building concerns. We thank the Subcommittee for examining this issue.

Within the scientific community, there are differing accounts as to whether or not one type of asbestos fiber is more harmful than another type. The Subcommittee has heard opposing views regarding the potential health risks associated with low level exposure to asbestos. And it has heard widely varied opinions on whether or not asbestos that is in good condition should be left in place and monitored carefully.

While we support the findings of the oft-quoted Science article, there is clearly a need for further study of this issue.

To that end, BOMA International is joining the EPA and various other organizations in funding the $12 million Health Effects Institute - Asbestos Research project.

We are confident this research will provide the information necessary to decide on the best approach to the asbestos issue.

However, the study is just now beginning, and building owners are in need of some direction today. We firmly believe that asbestos, in good condition, should be left in place and maintained carefully. Unnecessary removal is costing our industry billions of dollars and often increases the potential occupant exposure to airborne fibers.

Furthermore, there is increasing evidence that points to a real difference in the types of asbestos fibers - and the health risks associated with each type. Recent documentation shows that Chrysotile, which is found in over 90% of the nation's office buildings that have asbestos, does not pose a significant health risk if it is left undisturbed. If this is so, then there is additional reason to halt the unnecessary removal of asbestos from buildings. BOMA encourages Congress to affirm the need for further study of this issue. We pledge to provide both financial and research assistance in such an undertaking.

The most responsible way to ensure the safety of the building occupant is to address the situation at the point most likely to cause accidental exposures - construction and maintenance work.

Fibers become airborne when asbestos containing material (ACM) is disturbed. Rarely do building occupants come in contact with ACM; it is most frequently the maintenance crews that are in a position to disturb the material. It stands to reason, that minimizing the potential for disturbing the material at the primary level - the construction and maintenance crews - will serve to protect the building occupant from accidental exposure to asbestos.

Minimizing the hazards associated with asbestos removal is a much bigger problem. The proliferation of "rip and skip" operations causes us much concern. We will work closely with the National Asbestos Council in providing our members with information regarding the compliance records of abatement firms, and we will support the call for increased training and accreditation of abatement workers and supervisors.

BOMA International appreciates this opportunity to present our perspective to the Subcommittee.

* * *

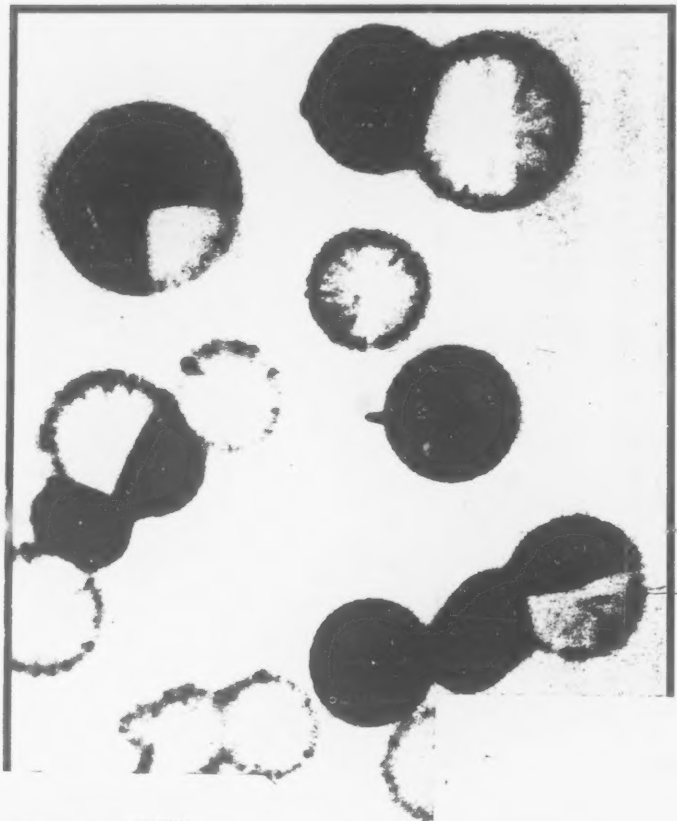
The Building Owners and Managers Association (BOMA) International is the oldest and largest trade association exclusively representing the office building industry. Its 7,200 members are directly responsible for five billion square feet of office space in North America. The Association currently has 103 local associations in the United States, Canada, and around the world.

JAN. 19, 1990

American
Association for the
Advancement of
Science

# SCIENCE

19 January 1990 $3.50
Vol. 247 ■ Pages 257–372



© Copyright Claimant: Reproduced by CRS for use of Members of Congress in their legislative duties

# Asbestos: Scientific Developments and Implications for Public Policy

B. T. MOSSMAN, J. BIGNON, M. CORN, A. SEATON, J. B. L. GEE

**Asbestos is a commercial term for a group of fibrous minerals often associated with the development of pulmonary interstitial fibrosis (asbestosis), lung cancer, and malignant mesothelioma in occupationally exposed individuals. The pathogenicity of different forms of asbestos varies—long, thin amphibole fibers are most pathogenic, particularly in the induction of mesothelioma. Available data do not support the concept that low-level exposure to asbestos is a health hazard in buildings and schools. The concentration of asbestos fibers in air, type of asbestos, and size of fibers must be considered in evaluation of potential health risks.**

ASBESTOS ENGENDERS BOTH FEAR AND PANIC IN U.S. society. Observation that asbestos-containing materials (ACM) have been used in schools, buildings, and hospitals, and the Asbestos Hazard Emergency Response Act (AHERA), a mandate from the Environmental Protection Agency (EPA) that requires inspection of the nation's public and private schools for asbestos, have resulted in the explosive growth of asbestos identification and removal companies. By EPA estimates, extension of EPA requirements to approximately 733,000 public and commercial buildings containing asbestos will cost $53 billion, discounted at 10% over 30 years (*1*). Because of uncertainties regarding the amount of asbestos and its condition in these buildings, estimates for removal of asbestos are as high as $100 to $150 billion (*2*).

Asbestos was shown to cause asbestosis at the turn of the century. Its association with the causation of lung and pleural tumors in asbestos miners and workers was demonstrated in the 1950s and 1960s, respectively (*3*). An important issue is whether these diseases are also hazards to the general population exposed to airborne levels of asbestos in schools and other buildings. Does available evidence support the concept that asbestos causes disease in the nonoccupational environment? What are the mechanisms of asbestos-induced fibrogenesis and carcinogenesis? Most importantly, have recent data been adequately considered in formulating policies in the United States for regulation and banning of asbestos? In this article, we summarize recent developments and discuss their implications for public policy.

## Physico-Chemical Characteristics of Asbestos

"Asbestos" is a broad commercial term for a group of naturally occurring hydrated silicates that crystallize in a fibrous habit. The legal definition of a fiber as promulgated by the EPA and other U.S. regulatory agencies is one that possesses a ≥3:1 aspect ratio. However, this definition has been criticized by mineralogists (*4*).

Asbestos fibers in ores are not respirable until released and made airborne during mining and processing. The family of asbestos minerals can be subdivided into serpentine and amphibole fibers (Fig. 1). Chrysotile, which accounts for over 90% of the world's production of asbestos, is the most common fibrous serpentine, whereas the amphiboles, a chemically diverse group of less industrially important minerals, include the fibrous minerals and crocidolite, amosite, anthophyllite asbestos, actinolite asbestos, and tremolite asbestos. Tremolite, actinolite and anthophyllite, which occur in both fibrous and nonfibrous forms, have been only rarely mined for use as commercial asbestos. Both the fibrous and nonfibrous forms of these amphibole minerals are sometimes found as contaminants of commercial deposits of chrysotile, talc, vermiculite, and other minerals (*4*). The nonfibrous forms of crocidolite and amosite are referred to as riebeckite and grunerite, respectively.

The various types of asbestos fibers differ in their chemical composition, morphology, and durability. Therefore, the biologic effects should be considered individually for each fiber type. Identification of specific types of asbestos in air samples requires sophisticated technology such as transmission electron microscopy, x-ray diffraction, or energy dispersive x-ray spectroscopy. The rod-like amphiboles appear to penetrate the peripheral lung more readily

**Table 1.** Summary statistics for average airborne fiber concentrations in U.S. schools (*88*) and buildings (*89*). The data used in the calculation of each statistic are the average concentrations (expressed as number of fibers greater than 5 μm in length per cubic centimeter of air) in a building (for indoor samples) or the concentration outside each building (for outdoor samples (*89*)). By visual inspection, category 1 buildings contained no asbestos-containing material (ACM), category 2 buildings contained ACM in primarily good condition, and buildings in category 3 showed at least one area of significantly damaged ACM. In the study on public buildings, 387 indoor and 48 outdoor air samples were evaluated. No asbestos fibers were detected in 83% of the 387 samples. The sample size is given in parentheses below each heading.

| Statistic | Schools (71) | Outdoor air (48) | Public buildings | | |
|---|---|---|---|---|---|
| | | | Category 1 (6) | Category 2 (6) | Category 3 (37) |
| Median | | 0.00000 | 0.00010 | 0.00040 | 0.00058 |
| Mean | 0.00024* | 0.00039 | 0.00099 | 0.00059 | 0.00073 |
| SD | 0.00053 | 0.00096 | 0.00198 | 0.00052 | 0.00072 |

*80th percentile = 0.00045, 90th percentile = 0.00083

---

B. T. Mossman is a member of the Department of Pathology of the University of Vermont, College of Medicine, Burlington, VT 05405. J. Bignon is director of the Unite INSERM de Recherche sur la Biopathologie et la Toxicologie Pulmonaire et Renale, Creteil, France. M. Corn is director of the Division of Environmental Health Engineering, School of Hygiene and Public Health, Johns Hopkins University, Baltimore, MD 21205. A. Seaton is director of the Institute of Occupational Medicine, Edinburgh, Scotland EH8 9SU. J. B. L. Gee is a director of the Winchester Chest Clinic and member of the Department of Internal Medicine, Yale University School of Medicine, New Haven, CT 06510.

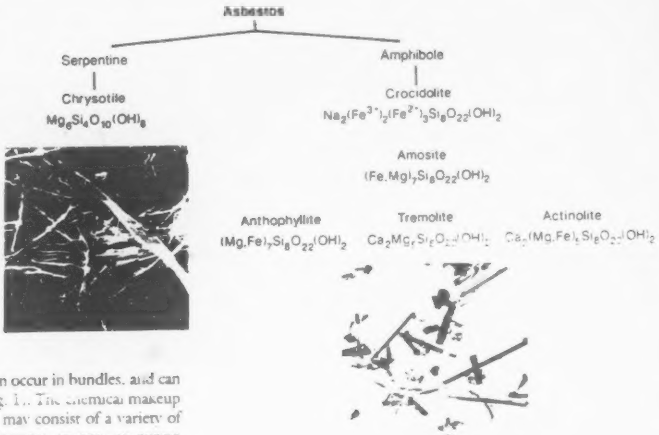

Asbestos
Serpentine
Chrysotile
$Mg_6Si_4O_{10}(OH)_8$
Amphibole
Crocidolite
$Na_2(Fe^{3+})_2(Fe^{2+})_3Si_8O_{22}(OH)_2$
Amosite
$(Fe,Mg)_7Si_8O_{22}(OH)_2$
Anthophyllite
$(Mg,Fe)_7Si_8O_{22}(OH)_2$
Tremolite
$Ca_2Mg_5Si_8O_{22}(OH)_2$
Actinolite
$Ca_2(Mg,Fe)_5Si_8O_{22}(OH)_2$

**Fig. 1.** Classification and morphology of asbestos fibers. The inserted photographs are scanning electron micrographs of Union Internationale contre le Cancer reference samples of chrysotile A (**left**) and crocidolite asbestos (**right**) (field of view is ~12 μm in both photographs). The amphiboles are depicted in order of their relative industrial importance.

than chrysotile fibers, which are curly, can occur in bundles, and can be intercepted at airway bifurcations (Fig. 1). The chemical makeup of each fiber type is complex, and fibers may consist of a variety of trace metals and organic compounds acquired in ores or during processing.

Asbestos is attractive to industry because of its resistance to heat and chemicals, high tensile strength, and lower cost compared to man-made materials. Although use of spray-on asbestos as a fireproofing material or insulation has been banned in this country, as well as in several European countries, asbestos is incorporated currently into cement construction materials (roofing, shingles, and cement pipes), friction materials (brake linings and clutch pads), jointing and gaskets, asphalt coats and sealants, and other similar products. As a result of these applications, an estimated 20% of buildings including hospitals, schools, and other public and private structures contain ACM (*1*). Asbestos in buildings does not spontaneously shed fibers, but physical damage to ACM by decay, renovation, or demolition can cause release of airborne fibers (*5*).

## Diseases Associated with Occupational Exposure to Asbestos

Occupational exposure to asbestos can cause four types of disorders: asbestosis; lung cancer; mesotheliomas of the pleura, pericardium, and peritoneum; and benign changes in the pleura (*3*). Asbestosis, a pulmonary interstitial fibrosis with excessive deposition of collagen, caused progressive lung stiffening, impaired gas exchange, disability, and death in many workers exposed before the enforcement of occupational standards. Lung cancers, that is, tumors arising in tracheobronchial epithelial or alveolar epithelial cells, have occurred in asbestos workers in most cases 20 or more years after their first exposure to asbestos. In general, lung cancers have been found in asbestos workers who are smokers and only rarely in nonsmokers (*6*). A number of epidemiologic studies have indicated that the relation between the development of lung cancers and cumulative exposure to asbestos is approximately linear, but wide variations in slope of the line occur apparently related to fiber type and industrial usage (*7*). Death rates from lung cancers in asbestos workers, as measured by standard mortality ratios (SMRs), the observed mortality of a cohort divided by the mortality of a control population, are lowest in chrysotile miners and workers manufacturing friction materials. In contrast, lung cancer deaths are higher in those mining and working with amphibole asbestos. Textile workers in a South Carolina plant in which chrysotile was used exhibited a striking increase in lung cancers with duration of exposure when compared to Canadian chrysotile miners and millers. Solvents and oils in textile production might act as cocarcinogens in the development of these lung tumors (*7*).

Diffuse malignant mesothelioma is a fatal tumor arising from mesothelial cells or underlying mesenchymal cells in the pleura, pericardium, and peritoneum (*8*). The time between diagnosis and initial occupational exposure to asbestos commonly exceeds 30 years. Smoking evidently does not enhance risk of mesothelioma in asbestos workers (*3*). Although mesotheliomas are extremely rare malignancies, that is, only 1648 were recorded from 1973 to 1984 in one survey covering approximately 10% of the U.S. population (*9*), they may account for as much as 18% of the proportional mortality in crocidolite workers (*10*). Mesotheliomas also have been observed after household exposure of family members of asbestos workers and in individuals living in close proximity to asbestos mines (*11*). Although mesothelioma has been considered by some as a disease pathognomonic of exposure to asbestos, approximately 20 to 30% of mesotheliomas occur in the general population in adults not exposed occupationally to asbestos (*12*). Mesotheliomas are rarely found in children.

Diagnosis of mesotheliomas is a challenge as the tumor may resemble metastases of other tumor types occurring in the pleura or peritoneum and assume a wide variety of microscopic appearances. Thus, death certificates may either underestimate (because these tumors are attributed to cancers of the gastrointestinal tract and other organs) (*13*) or overestimate the incidence of mesotheliomas. In France, mesotheliomas are overestimated by a factor of 3 on death certificates in comparison to the mesothelioma registry (*14*).

A number of benign pleural changes that rarely cause functional impairment have been observed in asbestos workers. These include pleural effusions, pleural fibrosis, pleural plaques, that is, accumulations of acellular collagen on the diaphragm and chest wall, and pseudotumors or infoldings of the lung often associated with plaques. These pleural changes may reflect exposure to asbestos but have no demonstrated relation to the development of mesothelioma.

Tumors of the gastrointestinal tract, larynx, and other organs including the kidney, ovary, pancreas, pericardium, eye, and lymphatic system, have been reported in some cohorts of asbestos workers (*13, 15*). In general, the enhanced SMRs for these tumors are not statistically distinguishable from normal SMRs and have not been confirmed in most cohorts. Both laryngeal and gastrointestinal tumors have other etiologies such as smoking, alcohol, diet, and intestinal polyposis that confound the interpretation of epidemiologic data.

## The Amphibole Hypothesis

The association of mesothelioma with asbestos exposure was first described in 1960 in the northwest Cape area of South Africa where long, thin crocidolite fibers were mined (*16*). Since then, an increased incidence of mesothelioma has been reported in a number of occupational settings including factories that presumably used only chrysotile. Within the past decade, sophisticated technology has allowed examination of the types of fibers in the lung tissue of these workers. Results revealed that many chrysotile-exposed workers showed an appreciable lung burden of amphibole fibers, which were used for brief periods in the workplace (*17*). The persistence of amphiboles in human lungs may be attributed to their increased ability to penetrate the peripheral lung, lack of clearance, or durability. In contrast, chrysotile has been found post-mortem in smaller amounts than expected in the lungs of asbestos workers (*18*). It disappears with time most likely because magnesium and silica are leached from the fibers (*19*). Recently, the lung content of asbestos and nonasbestos fibers has been compared in diagnosed cases of mesothelioma, lung cancer, and cardiovascular disease (controls) from the western coast of France, a region containing shipyards (*20*). The number of amphibole fibers (crocidolite and amosite) was significantly higher in lungs from mesothelioma patients, whereas numbers of chrysotile and nonasbestos fibers were similar in all groups. These data suggest that the lung burden of chrysotile and nonasbestos fibers bears no relation to the occurrence of these cancers.

Several recent studies indicate that the risk of pleural mesothelioma is lower where chrysotile is used without admixture or contamination by amphiboles (*21*). For example, a gradation of death rates from mesothelioma has been observed in both male and female asbestos-exposed cohorts. Mesothelioma has been responsible for approximately 6 to 8% of the proportional mortality in men working with mixtures containing crocidolite or amphibole (crocidolite or amosite) in comparison to less than 1% of the proportional mortality in men working with chrysotile (*10*). In female cohorts, the proportional mortality from mesothelioma was highest for amphibole exposure (10.6%) and lowest for chrysotile exposure (0.2%). Thus, these data suggest that amphiboles are the major cause of mesothelioma in asbestos workers.

Chrysotile miners and millers in Quebec who were supposedly exposed only to chrysotile have developed few mesotheliomas (*22*). However, recent fiber analyses on the lungs of both these workers and chrysotile factory workers showed the presence of tremolite (*23*). This amphibole in the fibrous form has been implicated as the causative agent of mesotheliomas and lung cancers in miners exposed to vermiculite heavily contaminated with tremolite (*24*). Although tremolite composes less than 1% of the asbestos dust in the Quebec mines and mills, the relative ratio of tremolite to chrysotile fibers in the lungs of Canadian miners and millers is related directly to their risk of developing mesothelioma (*25*).

For the reasons above, the few mesotheliomas observed in Canadian chrysotile workers appear to be attributable to fibrous tremolite, an observation compatible with other evidence that amphiboles are the most pathogenic asbestiform minerals. Likewise, recent data on London asbestos factory workers show that the severity of asbestosis and carcinoma of the lung (as well as mesothelioma) correlates with the lung burden of crocidolite and amosite asbestos and that the proportions of chrysotile and nonasbestos fibers are decreased in comparison to matched control patients (*26*). A British cohort exposed since 1970 to chrysotile at airborne levels not exceeding 0.5 to 1.0 fiber per cubic centimeter in the manufacture of friction materials showed no excess of deaths from lung cancer, other asbestos-related tumors, or chronic respiratory disease (*27*). These and other data (*7, 17, 21, 28*) suggest that amphiboles are more potent than chrysotile in the induction of fibrotic lung disease and associated lung cancers.

## Experimental Models of Asbestos-Induced Lung Disease

Several studies have shown that mesotheliomas are induced in a dosage-dependent fashion after intrapleural and intraperitoneal injection of asbestos and other asbestos-like fibers into rodents (*29*). Chrysotile was as carcinogenic as the amphiboles by these routes of administration. However, differences have been observed between the carcinogenicity of fibrous and nonfibrous materials. For example, in one study, fibrous tremolite was carcinogenic after intrapleural injection, whereas nonfibrous tremolite was noncarcinogenic at identical concentrations (*30*). Although the natural route of exposure to fibers by inhalation was circumvented in these experiments, they were useful in indicating that fibers longer than 8 μm and less than 0.25 μm in diameter have the most marked carcinogenic potential, that is, the "Stanton hypothesis." These data have been supported by the results of inhalation studies in rats in which short (≤5 μm in length) and long fiber preparations of amosite and chrysotile asbestos have been compared (*31*). In contrast to the batches of amosite and chrysotile asbestos containing many long fibers, short fibers of amosite produced neither asbestosis nor pulmonary tumors. Short chrysotile produced a small amount of asbestosis and malignancies, but these were attributed to contamination of the short chrysotile preparation by longer fibers. Fewer long than short fibers of both types were present in the lungs of all rats at the termination of exposure, but, regardless of size, fewer chrysotile fibers remained in the lung. These results support the observations that chrysotile fibers, in comparison to amphibole fibers, are cleared more rapidly from human lungs (*17*). This phenomenon and limited alveolar penetration of curly chrysotile bundles (rather than their inherent absence of carcinogenicity) may account for the apparent lack of association of chrysotile fibers with the development of mesothelioma in human cohorts.

The exorbitant costs of inhalation experiments with animals preclude long-term studies to determine the carcinogenic potential of asbestos at low-level exposures. The development of malignancies in rodents approaches the 2- to 3-year life-span of these animals (*32*), a period of too brief to reflect the consequences of the long-term solubility of chrysotile in the human lung.

## Mechanisms of Asbestos-Induced Inflammation and Fibrogenesis

Both epidemiologic and experimental data support the concept of a threshold for chrysotile-induced pulmonary fibrosis. In a sheep model of asbestosis, inflammation and histopathologic evidence of disease were not observed after less than 100 mg of chrysotile were injected into the trachea of the sheep (*33*). After brief, intense inhalation of chrysotile, the sheep accumulated alveolar macrophages (AMs) at areas of deposition of fibers (*4*). These cell types are viewed as "effector" cells of disease as they produce a mixture of fibroblast growth factors, chemotactic factors, and fibronectin. Prostaglandins, plasminogen activator, a heat-stable factor similar to platelet-derived growth factor (PDGF), lysosomal enzymes, and active oxygen metabolites, one or more of which may cause proliferation or functional impairment of neighboring epithelial cells and fibroblasts in the lung, were released after exposure of AMs to asbestos in vitro (*35*). These substances might mediate both acute and chronic inflammatory reactions in man and animals after inhalation of asbestos. In support of this hypothesis, AM-derived growth factor (AMDGF), PDGF, superoxide ($O_2^-$), and $H_2O_2$ were spontaneously released from AMs recovered by bronchoalveolar lavage from patients with asbestosis (*36*). Similarly, AMs lavaged from both mice and sheep that had an earlier intratracheal injection of chrysotile released enhanced amounts of a growth factor that stimulated proliferation of a human embryonic lung cell line (WI-38) (*37*).

In one study, AMs from both normal individuals and patients with idiopathic pulmonary fibrosis expressed a 4.2-kilobase messenger RNA complementary to c-*sis*, a proto-oncogene coding for the B chain of PDGF (*38*). The amounts were approximately fourfold higher from AMs of patients with pulmonary fibrosis. Because PDGF is mitogenic to mesenchymal cells, which possess [illegible] PDGF receptors, elevated levels of PDGF in lung tissue or fluids could induce lung fibroblasts to divide or to produce exorbitant amounts of collagen, the hallmark of the fibrotic lesion. Quiescent human mesothelial cells also undergo DNA synthesis after exposure to PDGF and a broad spectrum of other growth factors (*39*).

Within the past few years, several laboratories have focused on active oxygen species (AOS) as causative agents of both asbestosis and asbestos-related malignancies. Increased amounts of superoxide ($O_2^-$) have been produced after rodent AMs were exposed in vitro to long asbestos fibers, whereas generation was minimal after shorter fibers and nonfibrous particles were introduced (*40*). Smaller fibers and particles are incorporated into phagolysosomes by AMs, whereas longer fibers are incompletely phagocytosed, a process liberating more AOS.

The observation that exogenous administration of scavengers of AOS prevents asbestos-induced cell death to cultures of tracheal epithelial cells and lung fibroblasts (*41*) suggests that AOS are intimately related to asbestos toxicity even in the absence of AMs. Fibers may induce generation of AOS after phagocytosis or by extracellular mechanisms. For example, recent studies with asbestos in cell-free systems have demonstrated by electron spin resonance that chrysotile, crocidolite, and amosite generate AOS in the presence of $H_2O_2$ or physiological saline (*42*). Under these circumstances, $Fe^{2+}$ on the surface of the fiber appears to drive a modified Haber-Weiss (Fenton) reaction that results in production of the toxic hydroxyl radical ($OH^-$) from $H_2O_2$ and $O_2^-$. These reactions result in lipid peroxidation, which is prevented by incubation of asbestos with the iron chelator, desferroxamine (*43*).

At high concentrations, AOS are cytotoxic to cells of the respiratory tract, but at low concentrations they induce functional changes in rodent lung fibroblasts that may be critical to the pathogenesis of asbestos-induced fibrotic lung disease. For example, after addition of xanthine and xanthine oxidase (a chemical generating system producing $O_2^-$), rat lung fibroblasts in vitro produced increased amounts of cell-associated collagen in a pattern similar to that observed after their exposure to crocidolite asbestos (*40, 44*). In an inhalation model of rapid-onset asbestosis, osmotic pumps containing polyethylene glycol (PEG)–conjugated catalase, the enzyme scavenging $H_2O_2$, were implanted subcutaneously into rats before they were exposed to crocidolite for 20 days (*45*). This procedure boosted levels of catalase in the sera and lungs of these animals and ameliorated both the inflammation and the severity and extent of fibrotic lesions that normally develop after inhalation of asbestos. This study was the first successful experimental approach to the prevention of asbestos-associated lung disease. Moreover, the results support the concept of a cause and effect relation between AOS and the development of asbestosis.

## Mechanisms of Asbestos-Induced Carcinogenesis

Carcinogenesis is a multistage process that classically has been described in two stages (*46*). The "initiation" stage corresponds to a heritable genetic change (point mutation) induced in a cell by a carcinogenic substance. It is followed by the "promotion" stage, a series of events in which the initiated cell undergoes proliferative and genotypic changes conferring the malignant phenotype. During the past few years, the identification of a number of proto-oncogenes has resulted in a new understanding of the successive genetic events involved in the process of malignant transformation. Increased expression of these genes may cause the production of growth factors or growth-factor receptors [illegible] oncogenes [illegible]. These findings indicate that the distinction between genetic and epigenetic events in carcinogenesis is not simple, especially because chromosomal rearrangements or deletions associated with point mutation and activation or loss of genes can happen at any stage in the process of cell transformation.

Whether the multistage model is directly applicable to asbestos-associated carcinogenesis is unclear. Unlike most carcinogens, asbestos does not cause base substitution and frameshift mutations in bacterial-mutation assays (*47*). Of the 23 agents designated as group 1 human carcinogens by the International Agency for Research on Cancer (IARC), only asbestos and conjugated estrogens were nongenotoxic as defined by both the Ames test and rodent bone-marrow assays for detection of chromosomal aberrations or micronucleated erythrocytes (*48*). Although asbestos was weakly mutagenic in Chinese hamster lung cells (*49*), it was not mutagenic in liver epithelial cells or in Syrian hamster embryo (SHE) fibroblasts (*50*). Asbestos did not cause morphologic transformation of C3H 10T1/2 cells (*51*), but transformed both BALB/c#3T3 and SHE fibroblasts (*52*). Glass fibers and nonfibrous silica (albeit at much higher concentrations) also were active in the SHE bioassay. In this system, longer, thinner fibers were more potent in the induction of transformation and chromosomal anomalies, an observation consistent with the increased malignant potential of these fibers in comparison to shorter fibers or particles after their administration intrapleurally, intraperitoneally, or by inhalation to rodents (*29, 30*).

In these and other in vitro studies, the biologic effects of fiber types have been assessed comparatively on a mass (milligrams of fibers per dish) rather than a numerical (numbers of fibers of a given size per dish) basis. Cytotoxicity and cytogenetic effects of chrysotile, crocidolite, and erionite (an aluminosilicate fiber) recently were compared in Chinese hamster lung fibroblasts (V79 cells) (*53*). Numbers of chrysotile fibers required to produce cytotoxic or cytogenetic changes were several orders of magnitudes higher in comparison to erionite, the most potent fiber, or crocidolite, a fiber of intermediate potency. These results are consistent with the higher tumorigenic potential of erionite in rodent inhalation experiments (*54*).

In some studies, asbestos appears to augment the mutagenic and carcinogenic effects of chemical carcinogens and radiation. For example, both crocidolite and chrysotile increased the frequency of mutation and transformation in rodent epithelial cells and fibroblasts exposed to benzo[*a*]pyrene (BaP) (*50*) and radiation or radon alpha particles (*51*). However, synergistic effects of asbestos and BaP were not observed in two studies with SHE and rat mesothelial cells, respectively (*52, 55*).

The particulate nature of asbestos and its capacity to bind nucleic acids has prompted transfection studies in which asbestos was used as a vehicle for introducing DNA or RNA into a number of cell lines (*56*). Under these circumstances, asbestos was intermediate in rank in comparison to a number of other insoluble facilitators including calcium phosphate, talc, and kaolin, none of which have been associated with the induction of cancer.

After addition to human or rat mesothelial cells, both chrysotile (in rats) (*57*) and amosite (in humans) (*58*) have caused aneuploidy and altered growth characteristics after repeated passaging. Injection of rat mesothelial cells into nude mice after a single exposure to chrysotile did not cause tumors in animals, but multiple exposures (36 times) to chrysotile and repeated passaging resulted in tumorigenic cell populations (*57*). In contrast, human mesothelial cells displaying chromosomal abnormalities and growth alterations after duplicate exposures to cytotoxic concentrations of amosite were not tumorigenic in nude mice (*58*). Asbestos promoted the proliferation of mesothelial cells both in organ cultures of human mesothelium exposed to asbestos in vitro and in mice given intraperitoneal injections of asbestos (*59*).

Asbestos fibers come in contact with the chromosomes of rat mesothelial cells (*60*) and the mitotic apparatus of V79 (*53*) and SHE (*61*) cells in vitro. These interactions might induce chromosomal misaggregation or abnormalities. Several investigators have examined chromosomal aberrations in human mesotheliomas, but changes appeared inconsistent from tumor to tumor. The most common abnormalities involved inversions, translocations, and deletions of chromosomes 1, 3, 7, 9, 17, and 22 (*62*). Constitutively enhanced expression of the PDGF-B gene, the proto-oncogene *c-sis*, was observed in human mesothelioma cell lines when compared to normal human mesothelial cells (*63*).

In comparison to human mesothelial cells, human bronchial epithelial cells in vitro are relatively resistant to asbestos. In one study, concentrations of chrysotile, crocidolite, or amosite asbestos approximately ten times as high as that required for mesothelial cells were required to achieve a comparable increase in toxicity (as measured by a 50% decrease in colony-forming efficiency of human bronchial epithelial cells) (*64*). In another study, aneuploidy was not increased significantly over a range of concentrations of either crocidolite or chrysotile asbestos (*65*). This latter observation and th[illegible] grafts can cause the development of carcinomas following insertion of subcarcinogenic [illegible] of the polycyclic aromatic hydrocarbon, dimethylbenzo[*a*]anthracene (*66*), suggest that asbestos is a promoter in the development of lung cancers. In support of this concept, both crocidolite and chrysotile asbestos induced a number of biochemical and proliferative alterations in both rodent and human tracheal epithelial cell and organ cultures that were similar to those observed in mouse skin that had been treated with the tumor promoter [illegible]phorbol-13-acetate (TPA) (*67*). The repertoire of these asbestos-associated proliferative changes, which were masked in tracheal epithelial cells in a high-serum containing medium or by addition of transforming growth factor–type B (TGF-$\beta_1$) (*68*), included enhanced incorporation of $^3$H-thymidine, increases in colony-forming efficiency, and the development of squamous metaplasia, that is, conversion of differentiated mucociliary cells to keratinizing cells resembling epidermis. Induction of ornithine decarboxylase (ODC), a rate-limiting enzyme in the biosynthesis of polyamines that is increased in mouse skin after exposure to TPA but not after addition of nontumor promoting phorbol derivatives, also occurred in a dosage-dependent fashion in tracheal epithelial cells exposed to long, thin, asbestos and glass fibers. In contrast, nonfibrous particles and shorter fibers did not increase ODC activity at similar concentrations (*69*).

Until quite recently, it was unclear how asbestos triggered proliferation in tracheal epithelial cells. However, several pieces of data suggest that mechanisms of cell signaling by asbestos are similar to those observed with TPA, a soluble tumor promoter that binds directly to protein kinase C (PKC), a calcium- and phospholipid-dependent enzyme that activates a limb of the phosphoinositide signal-transduction pathway (*70*). Mitogenic concentrations of crocidolite asbestos caused increased accumulation of diacylglycerol in tracheal epithelial cells (*71*) and subsequent activation of PKC (*72*), presumably by activation of membrane phospholipases. The increased production of inositol tris- and tetrakisphosphates appeared responsible for the generation of diacylglycerol, which preceded increased cell division. Abrogation of crocidolite-induced ODC activity in tracheal epithelial cells by inhibitors of PKC and calcium channel antagonists (*69*) suggests that PKC is related causally to asbestos-associated cell proliferation.

Mechanisms other than tumor promotion by asbestos also may explain interactions between smoking and asbestos; these mechanisms could be important in the development of lung cancers in asbestos workers (*7, 73*). For example, smoking impaired clearance of amosite asbestos from rodent lungs and increased retention of fibers in airway epithelial cells (*74*). Both cigarette smoke and asbestos induced AOS in a synergistic fashion in vitro and damaged isolated bacteriophage DNA (*75*). AOS liberated from asbestos fibers also catalyzed the oxidation of 6-hydroxybenzo[*a*]pyrene to a more mutagenic and carcinogenic radical (*76*). Because crocidolite and chrysotile asbestos adsorbed BaP and acted as vehicles to increase both uptake of these lipophilic carcinogens and formation of DNA adducts in tracheal epithelial cells (*77*), fibers might facilitate the initiation of lung tumors by BaP.

## Public Policy

The available experimental and epidemiological data indicate that both fiber type and size are important determinants of the pathogenicity of asbestos. Although asbestos has caused disease in the workplace (*78*) and such occurrence has resulted in calls for regulations to protect workers (*79*), recent epidemiologic data are concordant with the suggestion that exposure to chrysotile at current occupational standards does not increase the risk of asbestos-associated diseases (*17, 21, 27, 28*). Unlike most other countries, [illegible] the European community [illegible] more stringent requirements for regulation and importation of amphiboles, federal policy in the United States does not differentiate between different types of asbestos.

Does airborne asbestos present a risk to the health of individuals in schools and other buildings? The available data do not indicate that asbestos-associated malignancies or functional impairment will occur as a result of exposure to most airborne concentrations of asbestos in buildings. First and foremost, the levels of airborne asbestos in buildings, even with damaged ACM, are magnitudes lower than concentrations in the unregulated workplace in the past and approximately 1/100 of the permissible exposure of 0.2 fibers per cubic centimeter of air in the U.S. workplace (*80*). Before the enforcement of occupational standards, workplace concentrations of 100 or more fibers per cubic centimeter of air were not uncommon (*81*). In contrast, surveys of asbestos in schools and public buildings show that the mean airborne concentrations are several thousand-fold lower (Table 1). With few exceptions, the type of asbestos fiber found predominantly in buildings is chrysotile. Accumulating evidence indicates that this asbestos type is probably not associated with the occurrence of mesotheliomas at low levels of exposure. For example, recent analyses on the fiber concentrations in lungs of asbestos workers showed that chrysotile workers with mesothelioma had 400 times the median lung fiber burden in comparison to workers exposed to amphiboles. Data indicate that mesotheliomas in chrysotile workers appeared at lung burdens comparable to that required for the development of asbestosis, a disease associated with occupational exposure to asbestos in the past unregulated workplace (*82*).

Transmission electron microscopy of air samples is essential for the identification and quantitation of finer asbestos fibers. In the United States and United Kingdom, the direct transmission electron microscopy method is advocated to determine airborne asbestos fiber concentrations in buildings. In France, the indirect transmission electron microscopy technique is used, and concentrations are expressed on a mass (milligram) basis. The limit for detection of fibers by phase-contrast microscopy is approximately 0.01 fibers per cubic centimeter of air, a concentration higher than that reported in most schools and buildings (Table 1). Moreover, phase-contrast microscopy cannot be used to identify types of fibers (asbestos or nonasbestos) or to detect fibers less than 0.5 μm in diameter, twice the diameter of fibers associated with the greatest biological activity and induction of tumors in rodents (diameters ≤0.25 μm, that is, Stanton fibers) (*29, 30*). Such long, thin asbestos fibers are rarely found in air samples of buildings (*81, 83*). As shown in Table 1, fiber concentrations from recent studies in buildings are comparable to levels in outdoor air, a point surely relevant to assessing the health risks of asbestos in buildings. Airborne concentrations of asbestos in buildings reported in the 1970s were somewhat higher, presumably because of earlier, less sophisticated sampling and analytical techniques.

Recent epidemiologic studies of deaths from mesothelioma in the general population also suggest that risk from asbestos in buildings is miniscule (*9, 10, 84*). In comparison to lung cancers (an average of 130,000 cases per year in the United States, largely attributed to smoking), an estimated 1,500 cases of mesothelioma per year occur in the U.S. population (*85*). The data on death rates from pleural or peritoneal mesotheliomas over the past 10 to 20 years indicate that mesotheliomas are increasing in males over 65 years of age who have a past occupational history of exposure to asbestos (*84*). By contrast, death rates from mesothelioma in females of all ages have declined slightly or remained constant. These results support the concept that asbestos in buildings is not an important risk factor, as one would expect increased mesotheliomas in both males and females in this case. A recent French study did not show increased risks of asbestos-associated malignancies, pleural plaques, or functional impairment of the lung (effects clearly present in asbestos workers) in persons exposed for 10 years to airborne asbestos in buildings (*86*). Although this survey is still in progress, no mesotheliomas have been observed to date among approximately 15,000 permanent occupants.

Although the validity of extrapolating from high to low dose levels has never been confirmed empirically in the evaluation of asbestos, calculated lifetime risks from mesotheliomas and lung cancers attributable to asbestos in schools and other buildings have appeared in recent years (*85, 87*). The linear dose-response equations in these models have been used with the assumption that there is no threshold for disease, a hypothesis which is open to question. Moreover, the range of estimated risks varies from study to study. With the exception of one analysis (*85*), differences between the pathogenic potential of chrysotiles and amphiboles have not been considered in these assessments, and the importance of fiber size has been ignored. Regardless, examination of combined data from published risk estimates shows that the asbestos-related total deaths (both lung cancers and mesotheliomas) due to exposure in schools are magnitudes lower than other commonly accepted risks in modern-day society (Table 2).

**Table 2.** Estimates of risk from asbestos exposure in schools in comparison to other risks in U.S. society. Data from six published risk estimates (*87*) in which total deaths (lung cancer and mesotheliomas) attributable to asbestos exposure over a lifetime were estimated per 1 million students exposed to 0.00024 fibers per cubic centimeter air (the mean airborne concentration in schools, Table 1) for five school years, beginning at age 10. Estimates indicate that the annual rate is 0.005 to 0.093 deaths per million students for an average life expectancy of 75 years. Modified with permission from Weill and Hughes (*90*).

| Cause | Annual rate (deaths per million) |
|---|---|
| Asbestos exposure in schools | 0.005 to 0.093 |
| Whooping cough vaccination (1970 to 1980) | 1 to 6 |
| Aircraft accidents (1979) | 6 |
| High school football (1970 to 1980) | 10 |
| Drowning (ages 5 to 14) | 27 |
| Motor vehicle accident, pedestrian (ages 5 to 14) | 32 |
| Home accidents (ages 1 to 14) | 60 |
| Long-term smoking | 1200 |

The AHERA ruling of 1986 brought asbestos to the attention of the U.S. public and instilled fears in parents that their children would contract asbestos-related malignancies because of high levels of airborne asbestos fibers in schools. Panic has been fueled by unsupported concepts such as the "one fiber theory," which maintains that one fiber of inhaled asbestos will cause cancer. As a result of public pressure, asbestos often is removed haphazardly from schools and public buildings even though most damaged ACM is in boiler rooms and other areas which are inaccessible to students or residents (*1*). The removal of previously undamaged or encapsulated asbestos can lead to increases in airborne concentrations of fibers in buildings, sometimes for months afterwards (*83*), and can result in problems with safe removal and disposal. Asbestos abatement also has led to the exposure of a large new cohort of relatively young asbestos removal workers. While these people should be protected by careful regulation of the circumstances of removal, they are often exposed under suboptimal working conditions.

As a result of the AHERA ruling, public and private schools are required to inspect for asbestos and inform parents if ACM are present. Although the law does not require or set standards for the removal of asbestos, schools, often with little expert advice, must submit a management plan detailing how they will deal with damaged asbestos and can be fined a maximum of $5000 per day for lack of compliance to deadlines. The EPA has recommended bulk sampling of ACM to determine the presence of asbestos and visual inspection to determine the course of action, rather than measurement of airborne levels of fibers—data that are far more important in determining the need, if any, for removal of ACM.

The available data and comparative risk assessments (Table 2) indicate that chrysotile asbestos, the type of fiber found predominantly in U.S. schools and buildings, is not a health risk in the nonoccupational environment. Clearly, the asbestos panic in the U.S. must be curtailed, especially because unwarranted and poorly controlled asbestos abatement results in unnecessary risks to young removal workers who may develop asbestos-related cancers in later decades. The extensive removal of asbestos has occurred less frequently in Europe.

Prevention (especially in adolescents) of tobacco smoking, the principal cause of lung cancer in the general population, is both a more promising and rational approach to eliminating lung tumors than asbestos abatement. Even acknowledging that brief, intense exposures to asbestos might occur in custodians and service workers in buildings with severely damaged ACM, worker education and building maintenance will prove far more effective in risk prevention for these workers.

---

### REFERENCES AND NOTES

1. Report to the Congress, *Study of Asbestos-Containing Materials in Public Buildings* (U.S. Environmental Protection Agency, Washington, DC, February 1988), p. 5.
2. M. Corn, paper presented at the 22nd International Congress on Occupational Health, Sidney, Australia, September, 1986.
3. B. T. Mossman and J. B. L. Gee, *N. Engl. J. Med.* **320**, 1721 (1989).
4. H. C. W. Skinner, M. Ross, C. Frondel, Eds., *Asbestos and Other Fibrous Materials* (Oxford Univ. Press, New York, 1988).
5. M. Corn, *Am. Ind. Hyg. Assoc. J.* **47**, 515 (1986).
6. R. Saracci, *Epid. Rev.* **9**, 175 (1987).
7. J. C. McDonald and A. D. McDonald, in *Asbestos-Related Malignancy*, K. H. Antman and J. Aisner, Eds. (Grune and Stratton, Orlando, 1987), pp. 57–79.
8. J. Chretien, J. Bignon, A. Hirsch, Eds., *The Pleura in Health and Disease* (Dekker, New York, 1985).
9. R. R. Connelly, R. Spirtas, M. H. Meyers, C. L. Percy, J. F. Fraumeni, *J. Natl. Cancer Inst.* **79**, 31 (1987).
10. A. D. McDonald and J. C. McDonald, in *Asbestos-Related Malignancy*, K. H. Antman and J. Aisner, Eds. (Grune and Stratton, Orlando, 1987), pp. 31–55.
11. H. A. Anderson, R. Lilis, S. M. Daum, A. S. Fishbein, I. J. Selikoff, *Ann. N.Y. Acad. Sci.* **271**, 311 (1976).
12. A. Hirsh *et al.*, *Am. J. Ind. Med.* **3**, 413 (1982).
13. R. Doll and J. Peto, in *Asbestos-Related Malignancy*, K. H. Antman and J. Aisner, Eds. (Grune and Stratton, Orlando, 1987), pp. 81–96.
14. J. Bignon, P. Sebastien, L. DiMenza, H. Payan, *Ann. N.Y. Acad. Sci.* **330**, 455 (1979).
15. D. A. Edelman, *Br. J. Ind. Med.* **45**, 75 (1988); C. K. Chan and J. B. L. Gee, *J. Occup. Med.* **30**, 23 (1988).
16. J. C. Wagner, C. A. Sleggs, P. Marchand, *Br. J. Ind. Med.* **17**, 260 (1960); G. K. Sluis-Cremer, *Ann. N.Y. Acad. Sci.* **132**, 215 (1965).
17. J. C. Wagner, G. Berry, F. D. Pooley, *Br. Med. J.* **285**, 603 (1982); M. J. Gardner, P. D. Winter, B. Pannett, C. A. Powell, *Br. J. Ind. Med.* **43**, 726 (1986); A. Churg, *Chest* **93**, 621 (1988); A. M. Langer and R. P. Nolan, in *Non-Occupational Exposure to Mineral Fibres*, J. Bignon, J. Peto, R. Saracci, Eds. (International Agency for Research on Cancer, Lyon, 1989), pp. 330–335.
18. J. C. Wagner *et al.*, *Ann. Occup. Hyg.* **26**, 423 (1982).
19. M. C. Jaurand, J. Bignon, P. Sebastien, J. Goni, *Environ. Res.* **14**, 245 (1977); A. Morgan and A. Holmes, *ibid.* **39**, 475 (1986).
20. A. Gaudichet *et al.*, *ibid.* **32** (suppl.), 213 (1988).
21. J. Dement, R. L. Harris, M. J. Symons, C. M. Shy, *Am. J. Ind. Med.* **4**, 421 (1983); M. Finkelstein, *Am. Rev. Respir. Dis.* **129**, 754 (1984); J. M. Hughes *et al.*, *Br. J. Ind. Med.* **66**, 161 (1987); A. D. McDonald, J. S. Fry, A. J. Woolley, J. C. McDonald, *ibid.* **40**, 368 (1983); *ibid.*, p. 361; C. G. Ohlson and C. Hagstedt, *ibid.* **42**, 397 (1985).
22. A. Churg, *Chest* **93**, 621 (1988).
23. P. Sebastien, J. C. McDonald, A. D. McDonald, B. Case, R. Harley, *Br. J. Ind. Med.* **46**, 180 (1989).
24. J. C. McDonald *et al.*, *ibid.* **43**, 436 (1986).
25. A. Churg, B. Wiggs, L. Depaoli, B. Kampe, B. Stevens, *Am. Rev. Respir. Dis.* **130**, 1042 (1984).
26. J. C. Wagner, M. L. Newhouse, B. Corrin, C. E. R. Rossiter, D. M. Griffiths, *Br. J. Ind. Med.* **45**, 305 (1988).
27. M. L. Newhouse and S. R. Sullivan, *ibid.* **46**, 176 (1989).
28. [illegible] M. L. Newhouse, *ibid.* **40**, 1 (1982); H. F. Thomas, I. I. Benjamin, P. C. Elwood, [illegible] *Br. J. Ind. Med.* **39**, 273 (1982).
29. J. M. G. Davis, in *Proceedings of 5th International Colloquium on Dust Measuring Technique and Strategy* (Asbestos International Association, Johannesburg, 1985), pp. 25–35; F. Pott and K. H. Friedrichs, *Naturwissenschaften* **59**, 318 (1972); M. F. Stanton and C. Wrench, *Br. J. Cancer* **48**, 797 (1972); M. C. Jaurand, J. Fleury, G. Monchaux, M. Nebut, J. Bignon, *J. Natl. Cancer Inst.* **79**, 797 (1987).
30. W. E. Smith, D. D. Hubert, H. J. Sobel, E. Marquet, in *Dusts and Disease*, R. Lemen and J. M. Dement, Eds. (Pathotox, Park Forest, IL, 1979), pp. 335–339.
31. J. M. G. Davis *et al.*, *Br. J. Exp. Pathol.* **67**, 415 (1986); J. M. G. Davis in *Non-Occupational Exposure to Mineral Fibers*, J. Bignon, J. Peto, R. Saracci, Eds. (International Agency for Research on Cancer, Lyon, 1989), pp. 33–45.
32. J. C. Wagner, G. Berry, J. W. Skidmore, V. Timbrell, *Br. J. Cancer* **29**, 252 (1974).
33. R. Begin, S. Masse, M. Rola-Pleszczynski, M. Boctor, G. Drapeau, in *Asbestos Toxicity*, G. L. Fisher and M. A. Gallo, Eds. (Dekker, New York, 1987), pp. 87–107.
34. A. R. Brody, L. M. Hill, B. Adkins, R. W. O'Connor, *Am. Rev. Respir. Dis.* **123**, 670 (1981).
35. B. T. Mossman and R. Begin, Eds., *Effects of Mineral Dusts on Cells* (North Atlantic Treaty Organization, Advanced Science Institute Series H, vol. 30) (Springer-Verlag, Berlin, 1989).
36. W. N. Rom, P. B. Bitterman, S. I. Rennard, A. Cantin, R. G. Crystal, *Am. Rev. Respir. Dis.* **136**, 1424 (1987).
37. I. Lemaire, H. Beudoin, S. Masse, S. Grondin, *Am. J. Pathol.* **122**, 205 (1986).
38. J. J. Mornex *et al.*, *J. Clin. Invest.* **78**, 61 (1986).
39. E. W. Gabrielson *et al.*, *FASEB J.* **2**, 2717 (1988); E. M. Laveck, A. N. A. Somers, L. L. Moore, B. I. Gerwin, J. F. Lechner, *In Vitro Cell Dev. Biol.* **24**, 1077 (1988).
40. K. Hansen and B. T. Mossman, *Cancer Res.* **47**, 1681 (1987); B. T. Mossman, K. Hansen, J. P. Marsh, M. E. Brew, J. Petruska, in *Non-Occupational Exposure to Mineral Fibres*, J. Bignon, J. Peto, R. Saracci, Eds. (International Agency for Research on Cancer, Lyon, 1989), pp. 81–92.
41. B. T. Mossman, J. P. Marsh, M. A. Shatos, *Lab. Invest.* **54**, 204 (1986); M. A. Shatos, J. P. Marsh, B. T. Mossman, *Environ. Res.* **44**, 103 (1987).
42. S. A. Weitzman and P. Graceffa, *Arch. Biochem. Biophys.* **228**, 373 (1984); R. Zalma, L. Bonneau, M. C. Jaurand, J. Guignard, H. Pezerat, *Can. J. Chem.* **65**, 2338 (1987).
43. S. A. Weitzman and A. B. Weitberg, *Biochem. J.* **225**, 259 (1985).
44. B. T. Mossman *et al.*, *Chest* **89**, 160 (1986).
45. B. T. Mossman *et al.*, *J. Free Rad. Biol. Med.* **2**, 335 (1986); B. T. Mossman *et al.*, *Am. Rev. Respir. Dis.*, in press.
46. I. Berenblum, *Cancer Res.* **1**, 44 (1941).
47. M. Chamberlain and E. M. Tarmy, *Mutat. Res.* **43**, 159 (1977); W. G. Light and E. T. Wei, in *The In Vitro Effects of Mineral Dust*, R. C. Brown, I. P. Gormley, M. Chamberlain, R. Davies, Eds. (Academic Press, London, 1980), pp. 139–145.
48. M. D. Shelby, *Mutat. Res.* **204**, 3 (1988).
49. S. L. Huang, *ibid.* **68**, 265 (1979).
50. B. Reiss, C. Tong, S. Telang, G. M. Williams, *Environ. Res.* **31**, 100 (1983); M. Oshimura, T. W. Hesterberg, T. Tsutsui, J. C. Barrett, *Cancer Res.* **44**, 5017 (1984); J. A. DiPaolo, A. J. DeMarinis, J. Doniger, *Pharmacology* **27**, 65 (1983).
51. R. C. Brown, A. Poole, G. T. A. Fleming, *Cancer Lett.* **18**, 221 (1988); T. K. Hei, C. R. Geard, R. S. Osmak, M. Travisano, *Br. J. Cancer* **52**, 591 (1985); T. K. Hei, in *Effects of Mineral Dusts on Cells*, B. T. Mossman and R. Begin, Eds. (North Atlantic Treaty Organization, Advanced Science Institute Series H, vol. 30) (Springer-Verlag, Berlin, 1989).
52. T. W. Hesterberg and J. C. Barrett, *Cancer Res.* **44**, 2170 (1984); Y. P. Lu, C. Lasne, R. Lowy, I. Chouroulinkov, *Mutagenesis* **3**, 355 (1988); S. O. Mikalsen, E. Rivedal, T. Sanner, *Carcinogenesis* **9**, 891 (1988).
53. L. D. Palekar, B. M. Most, D. L. Coffin, *Environ. Res.* **46**, 142 (1988); L. D. Palekar, J. F. Eyre, B. M. Most, D. L. Coffin, *Carcinogenesis* **8**, 553 (1987).
54. J. C. Wagner *et al.*, *Br. J. Cancer* **51**, 727 (1985).
55. M. J. Paterour, J. Bignon, M. C. Jaurand, *Carcinogenesis* **6**, 523 (1985).
56. J. D. Appel, T. M. Fasy, D. S. Kohtz, J. D. Kohtz, E. M. Johnson, *Proc. Natl. Acad. Sci. U.S.A.* **85**, 7670 (1988); G. R. Dubes and L. R. Mack, *In Vitro Cell. Dev. Biol.* **24**, 175 (1988).
57. M. C. Jaurand, L. Kheuang, L. Magne, J. Bignon, *Mutat. Res.* **169**, 141 (1986); St. Etienne *et al.*, in *Effects of Mineral Dusts on Cells*, B. T. Mossman and R. Begin, Eds. (North Atlantic Treaty Organization, Advanced Science Institute Series) (Springer-Verlag, Berlin, in press).
58. J. F. Lechner *et al.*, *Proc. Natl. Acad. Sci. U.S.A.* **82**, 3884 (1985).
59. K. T. Rajan, J. C. Wagner, P. H. Evans, *Nature* **238**, 346 (1973); P. A. Moalli, J. L. McDonald, L. A. Goodglick, A. B. Kane, *Am. J. Pathol.* **128**, 426 (1987).
60. N. S. Wang *et al.*, *Am. J. Pathol.* **126**, 343 (1987).
61. T. W. Hesterberg and J. C. Barrett, *Carcinogenesis* **6**, 473 (1985).
62. N. C. Popescu, A. P. Chahinian, J. A. DiPaolo, *Cancer Res.* **48**, 142 (1988); Z. Gibas *et al.*, *Cancer Genet. Cytogenet.* **20**, 190 (1986); M. Tiainen, L. Tammilehto, K. Mattson, S. Knuutila, *ibid.* **33**, 251 (1988).
63. B. Gerwin *et al.*, *Cancer Res.* **47**, 6180 (1987); M. A. Versnel, A. Hugemeijer, M. J. Bouts, T. H. van der Kwast, H. C. Haagsteden, *Oncogene* **2**, 601 (1988).
64. A. Haugen *et al.*, *Int. J. Cancer* **30**, 265 (1982).
65. Y. Kodama, C. J. Boreiko, S. C. Maness, T. W. Hesterberg, in preparation.
66. D. C. Topping and P. Nettesheim, *J. Natl. Cancer Inst.* **65**, 627 (1980).
67. B. T. Mossman, G. S. Cameron, L. Yotti, in *Cancer: A Comprehensive Survey: Cancer of the Respiratory Tract: Predisposing Factors*, M. J. Moss, D. G. Kaufman, J. M. Siegfried, [illegible] E. Steele, S. Nesnow, Eds. (Raven, New York, 1985), pp. 217–230.
68. A. M. Sesko and B. T. Mossman, *Cancer Res.* **49**, 2743 (1989).
69. J. P. Marsh and B. T. Mossman, *ibid.* **48**, 709 (1988).
70. Y. Nishizuka, *Science* **233**, 305 (1986).
71. A. M. Sesko, M. Cabot, B. T. Mossman, in preparation.
72. M. [illegible] J. P. Marsh, B. T. Mossman, in preparation.
73. E. C. Hammond, I. J. Selikoff, H. Seidman, *Ann. N.Y. Acad. Sci.* **330**, 473 (1979); J. C. McDonald, *Chest* **78** (suppl.), 374 (1980); G. Berry, M. L. Newhouse, P. Antonis, *Br. J. Ind. Med.* **42**, 12 (1985).
74. D. McFadden, J. L. Wright, B. Wiggs, A. Churg, *Am. Rev. Respir. Dis.* **133**, 372 (1986); D. McFadden, J. L. Wright, B. Wiggs, A. Churg, *Am. J. Pathol.* **123**, 95 (1986).
75. J. H. Jackson *et al.*, *J. Clin. Invest.* **80**, 1090 (1987).
76. P. Graceffa and S. A. Weitzman, *Arch. Biochem. Biophys.* **257**, 481 (1987).
77. A. Eastman, B. T. Mossman, E. Bresnick, *Cancer Res.* **43**, 1251 (1983).
78. I. Selikoff, E. C. Hammond, H. Seidman, *Cancer* **46**, 2736 (1980).
79. J. B. L. Gee and A. Bouhuys, *N. Engl. J. Med.* **285**, 1317 (1971).
80. In 1971, the Occupational Safety and Health Administration (OSHA) passed legislation restricting airborne asbestos in the workplace to five fibers greater than 5 μm in length per cubic centimeter air over an 8-hour time-weighted average. In 1986, this standard was reduced to 0.2 fibers per cubic centimeter air.
81. J. M. G. Davis and J. C. McDonald, *Br. J. Ind. Med.* **45**, 505 (1988).
82. A. Churg and J. L. Wright, in *Non-Occupational Exposure to Mineral Fibres*, J. Bignon, J. Peto, R. Saracci, Eds. (International Agency for Research on Cancer, Lyon, 1989), pp. 314–318.
83. G. J. Burdett and S. A. M. T. Jaffrey, *Ann. Occup. Hyg.* **30**, 185 (1986); M. Corn, in *Proceedings of the Symposium on Health Aspects of Exposure to Asbestos in Buildings*, J. D. Spengler, H. Ozkaynak, J. F. McCarthy, H. Lee, Eds. (Harvard Univ. Press, Cambridge, MA, in press); D. G. Massey and G. Fournier-Massey, *Hawaii Med. J.* **46**, 153 (1987); R. N. Sawyer, A. N. Rohl, A. M. Langer, *Environ. Res.* **36**, 46

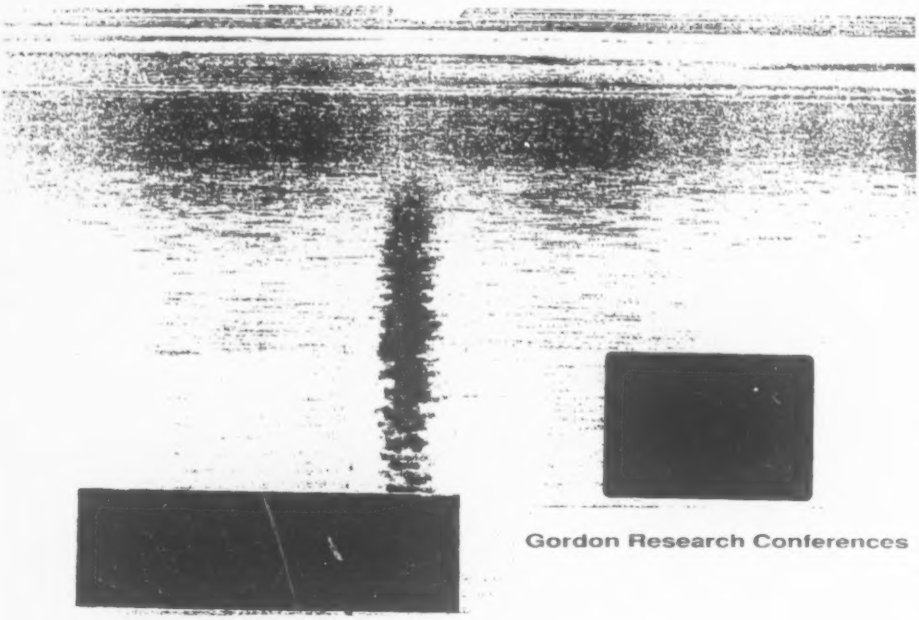
(1985).

84. V. Henderson and P. Enterline, *J. Natl. Cancer Inst.* 79, 31 (1987).
85. J. R. Hughes and H. Weill, *Am. Rev. Respir. Dis.* 133, 5 (1986).
86. S. Cordier *et al.*, *Arch. Environ. Health* 42, 303 (1987).
87. National Research Council, Committee on Nonoccupational Health Risks of Asbestiform Fibers, *Asbestiform Fibers: Nonoccupational Health Risks* (National Academy Press, Washington, DC, 1984); Report to the U.S. Consumer Product Safety Commission by the Chronic Hazard Advisory Panel on Asbestos (Consumer Product Safety Commission, Washington, DC, 1983); *Airborne Asbestos Health Assessment Update* (Environmental Protection Agency, Washington, DC, 1986); E. D. Acheson and M. J. Gardner, *Asbestos: The Control Limit for Asbestos* (Her Majesty's Stationery Office, London, 1983); Report on matters of health and safety arising from the use of asbestos in Ontario (Ontario Royal Commission, Ontario Ministry of the Attorney General, Toronto, 1984); R. Doll and J. Peto, *Asbestos: Effects on Health of Exposure to Asbestos* (Her Majesty's Stationery Office, London, 1985).
88. M. Corn, K. E. Crump, D. McFee, R. Lee, in preparation.
89. Battelle Columbus Division, Price Associates, Alliance Technologies Corporation, Energy Technology Consultants and Midwest Research Institute, *Assessing Asbestos in Public Buildings* (*EPA Contr. No. 68-02-4294*, draft report for the Exposure Evaluation Division, 1989).
90. H. Weill and J. M. Hughes, *Am. Rev. Public Health* 7, 171 (1986).
91. We thank L. Sabens, V. Kelieher, and M. Bergeron. Research in the laboratory of B.T.M. has been supported by grants from the National Cancer Institute (R01 CA33501), National Institute of Environmental Health Sciences (R01 ES03878), National Heart, Lung, and Blood Institute (R01 HL39469 and SCOR grant 14212), and American Cancer Society (BC 415). We also thank H. C. W. Skinner for her helpful comments.

AMERICAN
ASSOCIATION FOR THE
ADVANCEMENT OF
SCIENCE

# SCIENCE

2 MARCH 1990
VOL. 247 • PAGES 1009–1156
$3.50



Gordon Research Conferences

SCIENCE

2 MARCH 1990
VOLUME 247
NUMBER 4946

## The Asbestos Removal Fiasco

Removal of asbestos from buildings could cost as much as $50 to $150 billion. The content of asbestos fibers in the air of buildings containing asbestos is harmlessly small and essentially the same as in outdoor air.* Asbestos in buildings, unless damaged, does not shed fibers. The removal process releases asbestos fibers which could result in more cancer in the workmen than would have resulted in the usual occupants had the asbestos been left in place.

A puzzling defect in federal legislation and regulations is an arbitrary lumping together of disparate minerals and calling the lot of them asbestos. As a result, chrysotile, a serpentine mineral, is tarred with association with the dangerous amphibole crocidolite. The two minerals differ in composition, color, shape, solubility, and persistence in human tissue. Chrysotile is a white mineral with composition $Mg_6Si_4O_{10}(OH)_8$. It tends to be soluble and to disappear in tissue. Fibers tend to be curly and excluded from the periphery of the lung. Crocidolite is blue, has the formula $Na_2(Fe^{3+})_2(Fe^{2+})_3Si_8O_{22}(OH)_2$, and is relatively insoluble. It persists in tissue. Its fibers are long, thin, and straight and penetrate narrow lung passages. About 95 percent of the asbestos in place in the United States is chrysotile.

Another puzzling defect in federal performance is failure to give sufficient weight to epidemiological experience relating to chrysotile mines in Quebec. These mines have been operating since before 1900 and have produced about 40 million tons of chrysotile. In keeping with the lax practice of earlier days, mining operations were accompanied by large amounts of chrysotile dust. Wives of miners were heavily exposed; they dwelt in homes near the mines. Four epidemiological studies of the Quebec chrysotile mining localities show that lifelong exposure of women to dust from nearby mines caused no statistically significant excess disease.

The Environmental Protection Agency has fostered the view that a single fiber can cause cancer. This hypothesis is unproven. We live on a planet on which there is an abundance of serpentine- and amphibole-containing rocks. Natural processes have been releasing fibers throughout Earth history. We breathe in about 1 million fibers a year.

Another puzzle is a lack of expeditious effort by the EPA to obtain rigorous measures of indoor and outdoor levels of fibers. It is only recently that appropriate measurements have been made using transmission electron microscopy. Use of this equipment permits identification and quantitation of asbestos fibers. One would think that in a $50- to $150-billion program the first priority would be an accurate assessment of the problem. This lack of concern about determining the facts of exposure is also reflected in EPA policies with respect to schools.

Public and private schools are required to inspect for asbestos and to inform parents if asbestos-containing materials are present. Schools must submit a plan detailing how they will deal with damaged asbestos. They can be fined $5000 per day for failing to meet deadlines. The EPA has recommended bulk sampling and visual inspection to determine a course of action rather than measurement of airborne levels of fibers.

The removal process releases fibers into the air, sometimes creating greater concentrations of them than before the abatement work began. Remedial workers are being exposed to high occupational levels. EPA itself estimates that one half of all asbestos removal projects are done improperly.

Panic has not been confined to schools. Building owners broadly have been ripping out asbestos. If anything, the rush to remove asbestos is accelerating. EPA requires that asbestos be taken out of buildings before they are demolished or renovated. In addition, some owners have noted that the presence of asbestos has made it difficult to lease, sell, or insure asbestos-containing buildings. *The Environmental Contractor* has published an estimate that this year $7 billion will be spent on asbestos abatement—an increase of more than 30 percent during 1989. The estimate for 1993 is $11.5 billion.

The credibility of EPA has already been damaged. Unless policies are modified, the sums wasted in abatement and litigation will proliferate. Regulations should be modified to take into account the greatly differing hazards of the various asbestiform minerals. Standards for indoor air should be based on actual measurements of types and amounts of fibers.

—PHILIP H. ABELSON

---

*B. T. Mossman *et al.*, *Science* **247**, 294 (1990)

**American Association for the Advancement of Science**
*Science* serves its readers as a forum for the presentation and discussion of important issues related to the advancement of science, including the presentation of minority or conflicting points of view, rather than by publishing only material on which a consensus has been reached. Accordingly, all articles published in *Science*—including editorials, news and comment, and book reviews—are signed and reflect the individual views of the authors and not official points of view adopted by the AAAS or the institutions with which the authors are affiliated.

**Publisher:** Richard S. Nicholson
**Editor:** Daniel E. Koshland, Jr.
**News Editor:** Ellis Rubinstein
**Managing Editor:** Patricia A. Morgan
**Deputy Editors:** Philip H. Abelson (*Engineering and Applied Sciences*); John I. Brauman (*Physical Sciences*)

**EDITORIAL STAFF**
**Assistant Managing Editor:** Monica M. Bradford
**Senior Editors:** Eleanore Butz, Martha Coleman, Barbara Jasny, Katrina L. Kelner, Phillip D. Szuromi, David F. Voss
**Associate Editors:** Keith W. Brocklehurst, R. Brooks Hanson, Pamela J. Hines, Kelly LaMarco, Linda J. Miller
**Letters Editor:** Christine Gilbert
**Book Reviews:** Katherine Livingston, editor
**Contributing Editor:** Lawrence I. Grossman
**Chief Production Editor:** Ellen E. Murphy
**Editing Department:** Lois Schmitt, *head;* Mary McDaniel, Patricia L. Moe, Barbara P. Ordway
**Copy Desk:** Joi S. Granger, Margaret E. Gray, MaryBeth Shartle, Beverly Shields
**Production Manager:** James Landry
**Assistant Production Manager:** Kathleen C. Fishback
**Art Director:** Yolanda M. Rook
**Graphics and Production:** Holly Bishop, Julie Cherry, Catherine S. Siskos
**Systems Analyst:** William Carter

**NEWS STAFF**
**Correspondent-at-Large:** Barbara J. Culliton
**Deputy News Editors:** John M. Benditt, Jean Marx, Colin Norman
**News and Comment/Research News:** Mark H. Crawford, Constance Holden, Richard A. Kerr, Eliot Marshall, Joseph Palca, Robert Pool, Leslie Roberts, Marjorie Sun, M. Mitchell Waldrop
**European Correspondent:** Jeremy Cherfas
**West Coast Correspondent:** Marcia Barinaga

**BUSINESS STAFF**
**Circulation Director:** John G. Colson
**Fulfillment Manager:** Marlene Zendell
**Business Staff Manager:** Deborah Rivera-Wienhold
**Classified Advertising Supervisor:** Amie Charlene King

**ADVERTISING REPRESENTATIVES**
**Director:** Earl J. Scherago
**Traffic Manager:** Donna Rivera
**Traffic Manager (Recruitment):** Gwen Canter
**Advertising Sales Manager:** Richard L. Charles
**Marketing Manager:** Herbert L. Burklund
**Employment Sales Manager:** Edward C. Keller
**Sales:** New York, NY 10036: J. Kevin Henebry, 1515 Broadway (212-730-1050); Scotch Plains, NJ 07076: C. Richard Callis, 12 Unami Lane (201-889-4873); Chicago, IL 60914: Jack Ryan, 525 W. Higgins Rd. (312-885-8675); San Jose, CA 95112: Bob Brindley, 310 S. 16th St. (408-998-4690); Dorset, VT 05251: Fred W. Dieffenbach, Kent Hill Rd. (802-867-5581); Damascus, MD 20872: Rick Sommer, 11318 Kings Valley Dr. (301-972-9270); U.K., Europe: Nick Jones, +44(0647)52918; Telex 42513; FAX (0647) 52053.

**Information for contributors** appears on page XI of the 22 December 1989 issue. Editorial correspondence, including requests for permission to reprint and reprint orders, should be sent to 1333 H Street, NW, Washington, DC 20005. Telephone: 202-326-6500. **Advertising correspondence** should be sent to Tenth Floor, 1515 Broadway, New York, NY 10036. Telephone 212-730-1050 or WU Telex 968082 SCHERAGO, or FAX 212-382-3725.

MAY 18
1990

American
Association for the
Advancement of
Science

# SCIENCE

18 May 1990 $3.50
Vol. 248 ■ Pages 785–932

[redacted]

© Copyright Claimant: Reproduced by CRS for use of Members of Congress in their legislative duties

## Book Issue

## Letters

### Asbestos, Carcinogenicity, and Public Policy

Brooke Mossman *et al.*, in their generally excellent and informative article "Asbestos: Scientific developments and implications for public policy" (19 Jan., p. 294), propose that occupants of public buildings need not be concerned about chrysotile asbestos fibers when airborne fiber counts are low. The authors also state, "relatively young asbestos removal workers . . . should be protected." I am not sure that one can have it both ways, since in the last sentence of their paper Mossman *et al.* "acknowledg[e] that brief, intense exposures to asbestos might occur in custodians and service workers in buildings with severely damaged ACM [asbestos-containing materials]." The problem is that two essential elements are ignored in these conclusions: (i) a body of experimental data which shows that brief (1- to 3-hour), intense exposures to chrysotile asbestos fibers cause inflammatory, proliferative, and fibrogenic lesions in rats and mice within 48 hours after exposure (*1*), and (ii) damaged ACM is likely to leave on the top of false ceilings, pipes, and beams deposits of fibers that would not be found in routine airborne counts, but which could easily be aerosolized by numerous activities and could subsequently provide opportunities for the "brief, intense exposures." No one knows how many light bulbs a janitor must change or how many dusty corners a teacher must venture into before brief, intense exposures to chrysotile fibers will elicit a significant pathobiological response in the lung. The animal experiments suggest that only one such exposure is necessary; corresponding data for human exposures are not available. Thus, I am not convinced that it is prudent to consider chrysotile asbestos fibers innocuous and to leave ACM in situations where they eventually will deteriorate and provide a legacy for future generations of students, custodians, and removal workers. The authors make an excellent case for being cautious about unwarranted removal practices, but let us not think there is no problem just because airborne fiber counts in buildings are low.

ARNOLD R. BRODY
*National Institute of Environmental*
*Health Sciences,*
*Post Office Box 12233,*
*Research Triangle Park, NC 27709*

---

REFERENCES

1. L. Y. Chang, L. H. Overby, A. R. Brody, J. D. Crapo, *Am. J. Pathol.* 131, 56 (1988); A. R. Brody and L. H. Overby, *ibid.* 134, 133 (1989); P. D. McGavran, L. M. Moore, A. R. Brody, *ibid.* 136, 695 (1990).

There may have been good reason not to let the reader know of the long-term asbestos industry associations of at least four of the five authors of the polemical article by Mossman and her coauthors, in which they advise that this industry not be required to remove asbestos from schools and public buildings. Perhaps we can be told why this happened.

SHELDON W. SAMUELS
*Director,*
*Health, Safety, and Environment,*
*Industrial Union Department,*
*American Federation of Labor*
*Congress of Industrial Organizations,*
*815 16th Street, NW,*
*Washington, DC 20006*

The article by Mossman *et al.* is likely to mislead both the public and the scientific community about certain important issues concerning chrysotile asbestos. Since more than 95% of the asbestos used in the United States was chrysotile, this misdirection could have serious implications for public planning of the management of the asbestos in place in buildings throughout the United States. We present here a more complete discussion of some of the issues raised by Mossman *et al.*

Mossman *et al.* subscribe to the so-called "amphibole hypothesis," which they use to suggest that little, if any, cancer risk arises from exposure to chrysotile asbestos. They argue that the amphibole forms of asbestos—tremolite, amosite, and crocidolite—have substantially greater carcinogenic potential than chrysotile asbestos. They dismiss the "67 or more" mesothelioma cases that have occurred among Quebec chrysotile asbestos miners and millers (*1*) as "attributable to fibrous tremolite" because the lung burdens of tremolite in these individuals were higher than those of chrysotile. We believe that, as a parameter predictive of mesothelioma, "lung burdens" of fiber types are nearly worthless. As noted by Mossman *et al.*, chrysotile is a labile mineral that may disappear from lung tissue years before postmortem analysis is done. (Of course, the relevant carcinogenic mutations almost certainly occur years before cancer is detected.) This disappearance occurs because chrysotile, in contrast to amphibole minerals, splits apart longitudinally in tissue and can partially dissolve in body fluids. Mossman *et al.* imply that it is the 1% tremolite contamination of the chrysotile asbestos breathed by the miners and millers that caused the mesothelioma. We believe this argument is specious. Since the tremolite burden is proportional to the amount of chrysotile inhaled, it is also a measure of chrysotile dose. Thus, there is as strong a correlation with chrysotile dose as with tremolite burden.

The fallaciousness of the tissue burden argument can be seen further by considering mortality studies of asbestos-exposed workers when the results are analyzed in terms of exposure; it is essential to compare the risks of different fibers in terms of exposure. In four studies (*2*) of asbestos-textile production workers, the exposure was primarily to chrysotile asbestos; the percentage of nonchrysotile fiber ranged from 0 to 2%, plus an additional 1% of tremolite contamination. In these studies the percentage increased in lung cancer ranged from 1.0 to 2.8% per fiber-year per cubic centimeter of cumulative exposure (*3*). In five other studies (*4*) where workers were exposed to asbestos containing 100% amosite—an amphibole, 60% chrysotile plus 40% amosite, and 80 to 90% chrysotile plus 10 to 20% crocidolite, amosite, or both, the risk of lung cancer per fiber exposure was the same as that for the predominantly chrysotile exposures, within the statistical uncertainties of the data. It ranged from 0.5 to 4.3% per fiber-year per cubic centimeter for mixed chrysotile-amphibole exposure circumstances. Even a pure crocidolite exposure to miners demonstrated a similar risk—2.1 to 5.8% increase per fiber-year per cubic centimeter (*5*). Were the "amphibole hypothesis" correct, the risks of cancer in the asbestos textile studies would have been up to 100-fold less than were seen. Mossman *et al.* suggest the high risks might be due to "solvents and oils used in textile production." There is no evidence for this.

There is a significantly lower lung cancer risk per fiber exposure associated with chrysotile mining and milling (*6*) than that associated with textile production in which only chrysotile (as mined) or predominantly chrysotile are used. The reason for this difference is not fully understood, but some, perhaps all, of the greater risk in textile mills may result from the presence of a greater percentage of thin, uncounted, but highly carcinogenic fibers that are produced during textile production in the carding process and in the high-speed spinning and weaving processes, where thin fibers may split off from the threads.

Similarly, the risk of mesothelioma per fiber exposure in three studies, where it can be estimated directly from exposure and incidence data, is identical to that for exposures to 98% chrysotile plus 2% crocidolite, 60% chrysotile plus 40% amosite, and 100% amosite, respectively. Moreover, in most other studies where the mesothelioma risk cannot be estimated directly, the ratio of the number of mesotheliomas to excess lung cancers is the same for exposures to predominantly chrysotile, to 100% amosite, and to mixtures of chrysotile, amosite and crocidolite, within the uncertainties of the estimation. The ratio for 100% crocidolite exposures is about twice as great (*3*).

These data on humans are corroborated by similar data obtained in experimental inhalation studies by Wagner *et al.* (*7*) with rats. For equal exposures, the greatest numbers of cancers was produced in these studies by chrysotile asbestos. The amount of asbestos retained in the lung after conclusion of the 2-year inhalation experiment was also measured by Wagner *et al.*, who found that the mass of amphibole fibers in the lungs was about 15 times the mass of chrysotile fibers, although the air the animals breathed contained equal masses of each asbestos type. Thus, the chrysotile fibers, although conveying an equal (or greater) risk of malignancy than the amphibole fibers, were clearly less persistent in lung tissue than the amphiboles. Further, solvents and oils could not have played a role in these experimental results.

Mossman *et al.* state that "the rod-like amphiboles appear to penetrate the peripheral lung more readily than chrysotile fibers, which are curly, can occur in bundles, and can be intercepted at airway bifurcations." While a typical mine specimen of chrysotile contains a nonrespirable fraction, a substantial proportion is of a diameter that is respirable. This respirable fraction, including the thin, sublight microscopic, most highly carcinogenic fibers, increases in the successive stages of product manufacturing and use.

One of the authors of the *Science* article previously analyzed the fiber types found in lung parenchyma and parietal pleura of workers exposed to both chrysotile and amphibole asbestos. Contrary to the assertion [illegible] Mossman *et al.* that amphiboles more readily penetrate to the pleura than do chrysotile fibers, it was concluded that "in pleural tissues short chrysotile fibers frankly outnumber long fibers of amphibole type" (*8*). Why do Mossman *et al.* now repudiate this important finding? It should be noted that most mesotheliomas occur in the parietal pleura and that measurements of fiber levels in this tissue are likely to be a more relevant parameter than are lung tissue burdens.

It is not known precisely how asbestos—or any mineral fiber—interacts with cells to induce cancer. There are, however, recent data on how mineral fibers interact with a cell's genetic apparatus to cause mutations. Mossman *et al.* cite studies showing a lack of mutagenicity of asbestos fibers as demonstrated by the Ames test and other transformation assays. These assays were, however, performed by making a direct application of asbestos fibers, a route of exposure that may not be most relevant to human cancer. Also Mossman *et al.* de-emphasize recent evidence that chrysotile is mutagenic by means of its ability to transfer DNA into cells (*9*), apparently because no epidemiological studies have been done on kaolin or calcium phosphate. This capacity to transfect is, however, a recognized avenue for mutagenicity (*10*). In transfection studies conducted thus far, chrysotile asbestos has been seen to be more potent than calcium phosphate. Unlike calcium phosphate, chrysotile fragments the newly introduced DNA, a process now known to greatly enhance mutagenesis. It is likely that all cell transfectants are mutagens, but there are no published studies relating carcinogenesis to a particular tissue's accessibility to transfectants. This area should be further explored.

Mossman *et al.* review data on air concentrations of asbestos measured in buildings and in the outside air and use these data to derive estimates of risk for exposures in buildings. These data have two weaknesses. First, as evident by the fact that no asbestos fibers were observed in 83% of the samples analyzed, inadequate analytical techniques could have been used. In order to obtain a meaningful estimate of an asbestos concentration, at least four fibers should be counted in each sample analyzed. It would appear that at least ten times more filter area should have been scanned in these samples than was in fact examined. Second, as the authors of one of the air studies acknowledge (*11*), their results indicated building levels ten times lower than those of three other studies of airborne asbestos concentrations in buildings (*12*), which suggests the possibility of analytical error.

In addition, short-term air sampling is not likely to reflect actual long-term contamination levels in buildings. Contamination of the air in buildings comes largely from episodic releases during maintenance work or from physical abuse to the material. The very act of sampling alters the likelihood of such activities. Building maintenance or optional repair work will not be scheduled by a building manager when sampling is in progress. Sawyer (*13*) showed that the magnitude of episodic releases could be substantial. Concentrations ranging from 1 to 18 fibers per cubic centimeter were measured during the changing of light fixtures or removal of a ceiling panel. Both x-ray abnormalities and pulmonary function deficits have been associated with asbestos exposure among school custodians (*14*), demonstrating the fact of past, widespread exposures in buildings. Indeed Mossman *et al.* state that "brief, intense exposures to asbestos might occur to custodians and service workers in buildings. . . ."

Mossman *et al.* dismiss concern about asbestos exposures of 0.002 fiber per cubic centimeter, a level 1/100 the allowed occupational level and approximately ten times greater than background asbestos levels. However, it has been calculated by three U.S. agencies [the Consumer Product Safety Commission (CPSC), the National Academy of Sciences, and the Environmental Protection Agency (EPA)] (*3, 15*) that the lifetime risk for a 13-year exposure, beginning at age 5, ranged from 4 to 12 asbestos cancer deaths per 100,000 individuals exposed to a concentration of 0.002 fiber per cubic centimeter. For a school population of 20 million pupils, this translates into 800 to 2400 excess cases of cancer. When evaluating widespread environmental risks, one must focus on the population risks rather than the individual risks. Fortunately, because of action already taken, the average asbestos concentration in most school buildings is less than 0.002 fiber per cubic centimeter. However, even if the exposures in schools were as low as the 0.00024 suggested by Mossman *et al.*, the lifetime mortality for the current school population would still range from 100 to 300 asbestos cancers.

Finally, we consider the risk assessment projections of Mossman *et al.* in an ethical context. Rather than comparing asbestos risks (which are involuntary) with voluntary risks (smoking, school football) or risks that remain high despite expenditures of substantial public and private money (aircraft and highway accidents), we suggest comparing them with other involuntary, environmental risks that are controlled by regulatory agencies (pesticide exposures, drinking water contamination). In a review of regulatory actions taken by the Food and Drug Administration, the CPSC, and the EPA (*16*), it was found that when the population risk exceeded one death per year, the individual lifetime risk was usually regulated if it exceeded one per 1 million for a lifetime exposure. Only 8 of 31 carcinogenic exposures that exceeded this level were not regulated. The eight involved four agents: saccharin, aflatoxin, formaldehyde, and polycyclic organic matter. *Average* asbestos school building lifetime cancer risks range from 0.5 to 10 per 100,000 for only a 13-year exposure. In some schools with particular problems the risk could be higher. Thus, the risks that the EPA is attempting to reduce in school buildings by their Asbestos Hazard Emergency Response Act regulation (*17*) are in the mainstream of regulatory action taken by the U.S. government. The EPA does not require that asbestos be removed in school buildings or suggest that it be removed "haphazardly." It requires that buildings be inspected for asbestos and, if asbestos material is found, an operations and maintenance program be put in place. The program involves notification of the public and building occupants, training of workers to prevent release of asbestos during maintenance activities, and repair of damaged asbestos material or its replacement, if future damage cannot be prevented. Removal is the option of last resort, and it is to be performed only when other approaches are not feasible or have failed. When removal must be undertaken, the EPA requires that it be conducted in a highly regulated manner that, if followed, will minimize risks to workers and prevent residual contamination.

**William J. Nicholson**
**Edward M. Johnson**
**John S. Harington**
*Mount Sinai School of Medicine,*
*New York, NY 10029*
**James Melius**
*New York Department of Health,*
*Albany, NY 12203*
**Philip J. Landrigan**
*Mount Sinai School of Medicine,*
*New York, NY*

### REFERENCES AND NOTES

1. The number of known mesotheliomas among Quebec asbestos miners was given as 67 by J. C McDonald in a presentation at the Collegium Ramazzini Workshop on Disease Potential of Different Asbestos Varieties, Ottawa, Ontario, Canada, 22 March 1989.
2. J. M. Dement, R. L. Harris, Jr., M. J. Symons, C. Shy, *Am J Ind Med* **4**, 399 (1983); A. D. McDonald, J. S. Fry, A. J. Woolley, J. C. McDonald, *Br J Ind Med* **40**, 361 (1983); J. Peto *et al.*, *Ann Occup Hyg* **29**, 305 (1985); A. D. McDonald, J. D. Fry, A. J. Woolley, J. C. McDonald, *Br J Ind Med* **40**, 368 (1983).
3. Details of the calculation of these unit exposure risks can be found in *Airborne Asbestos Health Assessment Update* (Environmental Protection Agency, Washington, DC, 1986).
4. H. Seidman, I. J. Selikoff, S. K. Gelb, *Am J Ind Med* **10**, 479 (1986); I. J. Selikoff, E. C. Hammond, H. Seidman, *Ann N Y Acad Sci* **330**, 91 (1979); W. J. Nicholson, *ibid* **271**, 152 (1976); V. L. Henderson and P. E. Enterline, *ibid* **330**, 117 (1979); H. Weill, J. Hughes, C. Waggenspack, *Am Rev Respir Dis* **104**, 345 (1979); M. M. Finkelstein, *Br J Ind Med* **40**, 138 (1983).
5. B. K. Armstrong *et al.*, *Br J Ind Med* **45**, 5 (1988).
6. J. C. McDonald, F. D. K. Liddell, G. W. Gibbs, G. E. Eyssen, A. D. McDonald, *ibid* **37**, 11 (1980).
7. J. C. Wagner *et al.*, *Br. J. Cancer* **29**, 252 (1974).
8. P. Sebastien *et al.*, in *Dusts and Diseases*, R. Lemen and J. M. Dement, Eds. (Pathotox, Park Forest South, IL, 1979), pp. 65–85.
9. J. D. Appel *et al.*, *Proc Natl Acad Sci U.S.A.* **85**, 7670 (1988).
10. L. Bardwell, *Mutagenesis* **4**, 245 (1989).
11. J. Chesson *et al.*, *Environ Resh* **51**, 100 (1990).
12. G. J. Burdett and S. A. M. T. Jaffrey, *Ann Occup Hyg* **30**, 185 (1986); E. J. Chatfield, in *Asbestos Fibre Measurements in Building Atmospheres, Proceedings*, E. J. Chatfield, Ed. (Ontario Research Foundation, Mississauga, Ontario, 1986); D. J. Pinchin, *Asbestos in Buildings, Study No. 8* (Royal Commission on Matters of Health and Safety Arising from the Use of Asbestos in Ontario, Toronto, Ontario, 1982).
13. R. Sawyer, *Environ Res* **13**, 146 (1977).
14. L. C. Oliver, N. L. Sprince, R. E. Green, *Am Rev Resp Dis* **139**, A211 (1989).
15. *Report to the U.S. Consumer Product Safety Commission by the Chronic Hazard Advisory Panel on Asbestos* (Consumer Product Safety Commission, Washington, DC, 1983); National Academy of Sciences, *Asbestiform Fibers: Nonoccupational Health Risks* (National Academy Press, Washington, DC, 1984).
16. C. C. Travis *et al.*, *Environ Sci Technol* **21**, 415 (1987).
17. Environmental Protection Agency, *Fed Reg* **52**, 41826 (1987).

**Table 1.** Average indoor concentrations of airborne asbestos fibers longer than 5 micrometers.

| Sites | Number of buildings | Number of samples | Structures/ cm$^3$ |
|---|---|---|---|
| GSA buildings | | | |
| No ACM* | 6 | 42 | 0.0 |
| Undamaged ACM* | 6 | 42 | 0.00007 |
| Damaged ACM* | 37 | 256 | 0.00008 |
| 71 schools | 71 | 328 | 0.00024 |
| Minnesota universities | 34 | 170 | 0.00003 |
| Maryland public buildings | 72 | 91 | 0.00009 |

*Differences in these concentrations among three groups of buildings are not statistically significant.

The article by Mossman *et al.* contains data on airborne asbestos in buildings from two sources: a survey conducted by the Environmental Protection Agency (EPA) of Government Services Administration (GSA) buildings and data from 71 schools involved in impending litigation regarding the presence of asbestos-containing building products. The levels reported by Mossman *et al.* for the GSA buildings were incorrectly identified as pertaining to asbestos structures longer than 5 micrometers, whereas in reality the figures were for total asbestos structures (*1*). Thus, the airborne concentrations in GSA buildings were lower than reported by Mossman *et al.* Table 1 contains the correct average levels from the GSA data along with data from the 71 schools. Also included are previously unpublished data from Minnesota state university buildings and Maryland state buildings; these data were generated in connection with impending litigation and were collected and analyzed by the same organizations employing exactly the same protocols as those used in the 71-school study.

On the basis of the study used by Mossman *et al.* to estimate annual death rates from asbestos exposure and other activities, the expected number of premature deaths among students exposed for 6 years to 0.00024 structure per cubic centimeter longer than 5 micrometers is 0.36 per million (*2*). By the same methods, the risk from 20 years of occupational exposure to 0.00007 structure per cubic centimeters longer than 5 micrometers is 0.43 per million.

In comparison, by combining the National Council on Radiation Protection estimate of the radiation exposure from naturally occurring radionuclides in masonry building products (*3*) with the BEIR V committee's potency estimates (*4*), one obtains a lifetime risk of 15 per million from 6 years of school, and 46 per million from 20 years of work in masonry buildings. These risks, which do not include the much larger risks from radon (*4*), are 40 to 100 times larger than the corresponding risks from exposure to asbestos in buildings.

Concern has been raised that airborne levels may be increased during brief periods due to disturbance of asbestos materials and that these increases may not be reflected in routine monitoring. However, the data in Table 1 are based on a total of 1185 samples, each collected over a period of two consecutive days during normal building activities, which cumulatively are equivalent to more than 3 years of continuous sampling. These data therefore suggest that such disturbances either occur infrequently or else do not produce high exposures.

**Kenny S. Crump**
*Clement Associates, Inc.,*
*1201 Gaines Street,*
*Ruston, LA 71270*

### REFERENCES

1. K. Crump and D. Farrar, *Reg. Toxicol. Pharmacol.* **10**, 51 (1989).
2. J. M. Hughes and H. Weill, *Am Rev Res Dis* **133**, 5 (1986).
3. National Council on Radiation Protection and Measurements, *Radiation Exposure of the U.S. Population From Consumer Products and Miscellaneous Sources* (Report No. 95, Bethesda, MD, 1987).
4. National Research Council, *Health Effects of Exposure to Low Levels of Ionizing Radiation, BEIR V* (National Academy Press, Washington, DC, 1990).

*Response*: Brody presents his work with mice and rats as "a body of experimental data" showing a "significant pathobiological response in the lung" after a single, intense exposure to chrysotile asbestos (*1*). He then attempts to compare these rodent inhalation studies to asbestos exposures encountered by janitors changing light bulbs and teachers venturing into "dusty corners." His arguments are flawed. While Brody's work shows morphometric changes and an increase in incorporation of tritiated thymidine by a variety of cell types in rodent lungs after inhalation of chrysotile, he does not mention that labeling in asbestos-exposed lungs returns to normal levels that persist throughout the 30-day observation period. Brody demonstrates no fibrotic lesions by accepted functional and histopathologic criteria (*2*). These asbestos-induced mitogenic responses reflect acute reversible changes and have no necessary relation to the development of pulmonary fibrosis. In Brody's experiments, animals were exposed for 1 and

5 hours to astronomical airborne concentrations (hundreds of billions of fibers per cubic meter of air) (*3*) of chrysotile. We are hard-pressed to envision a comparable situation in which teachers or students would remain for extended periods of time in dust clouds where vision would be significantly impaired.

Brody appropriately raises the issue of potential exposure of maintenance and custodial staff to asbestos-containing materials (ACM) in buildings. The Occupational Safety and Health Administration (OSHA) has said that these workers are entitled to the coverage of the OSHA Asbestos Standard for Construction (*4*). This permanent standard has provisions for initial determination of exposure, a permissible exposure limit for airborne asbestos, work practices, personal protective equipment, and medical surveillance procedures. As with other OSHA standards, the employer is responsible for ensuring adherence to the provisions of the standard. In buildings, this responsibility falls to the school board. The asbestos standard was amended in 1986 (*4*). The agency usually allows 60 days for those covered to comply. Building owners and School Boards not using operations and maintenance (O&M) plans that protect maintenance and custodial personnel are in technical violation of the standard. Each building must be evaluated for appropriate protective measures. Our experience indicates that some buildings require few and relatively simple procedures, while others require more elaborate procedures. There is no "universal" O&M plan to effectively protect maintenance and custodial personnel.

We appreciate the opportunity to reply to the misinterpretations of data and arguments presented by Nicholson *al.* We were unable to contact McDonald concerning the "67 or more" cases of mesothelioma hat have occurred among Canadian chryso-ile miners and millers. Unfortunately, ab-tracts and papers from McDonald and oth-r presenters at the referenced conference 5), which was organized by the Mount inai group, were neither invited nor published in detail or in summary. Howev-r, the recent review (*6*) cited in our article hows that among the 53 chrysotile-induced leural mesotheliomas recorded in the litera-re, 10 were from industry (with suspicion mixed chrysotile and amphibole expo-re) and 41 were miners in geographic eas where tremolite was a natural contami-nt of the chrysotile ore. We note that "the lative *ratio* of tremolite to chrysotile fibers the lungs of Canadian miners and millers related directly to their risk of developing esothelioma (*7*)."

Nicholson *et al.* present criticisms concerning the "fallaciousness of the tissue burden argument" in drawing conclusions about the importance of fiber type in the development of mesothelioma. Our conclusions are based primarily on a review of the epidemiology of mesothelioma mortality in cohorts of workers exposed predominantly to "chrysotile-only," amphiboles alone, or mixed concentrations of fibers (amphibole plus chrysotile). We emphasize that most mesotheliomas judged in "chrysotile only"–exposed individuals were actually amphibole-related, as confirmed by lung tissue fiber types and geological data. If tremolite contamination is indeed the agent of mesothelioma in Canadian miners and millers, then it is logically necessary that extremely high concentrations of chrysotile deliver a critically important dose of tremolite to the lung. We do agree that the data on the different pathogenic potential of asbestos types in the causation of lung cancer is less compelling than that for mesothelioma.

As we stated, South Carolina asbestos textile workers exhibit "a striking increase in lung cancers with duration of exposure when compared to Canadian chrysotile miners and millers." Most of the asbestos to which the textile workers were exposed was Quebec chrysotile. However, airborne dust levels in the textile plant were estimated (as air concentrations of fibers were unavailable) as one-tenth of those encountered in mines and mills, an observation supporting the data that numerical concentrations of asbestos fibers in lung were higher in miners and millers than in textile workers. Length and diameter distributions of chrysotile and tremolite fibers in these worker populations were similar (*8*). Thus, one cannot attribute lung cancers in these textile workers to increased exposure or differences in fiber size. However, there are two potential explanations for increased lung tumors in workers in this textile plant. *First*, mineral oils and hydrocarbons may be inculpated, as was first suggested by Harington (*9*) and later by the McDonalds (*8*). We realize that this explanation has not been verified. Second, the plant in question was unusually dusty as burlap bags were employed to trap asbestos fibers and were beaten by workers to recycle these fibers.

Nicholson *et al.* incorrectly interpret the rodent inhalation studies by Wagner *et al.* (*10*) as concluding that the greatest numbers of cancers were produced in these studies by equal exposures to chrysotile. In fact, numbers of asbestos-induced mesotheliomas in these rats were low (four in crocidolite-exposed rats, none in Rhodesian chrysotile-exposed rats, and four in Canadian chrysotile-exposed rats) and equivalent to numbers occurring spontaneously in this species (*11*). The majority of asbestos-induced lung tumors were adenomas also occurring in control rats. We emphasized that rodents were exposed to greater *numbers* of chrysotile fibers in comparison to amphibole fibers on an equivalent weight basis (*3*).

We do not make the assertion that amphiboles more readily penetrate the pleura, nor do we repudiate a publication by one of us (J.B.) showing that short chrysotile fibers outnumber long amphibole fibers in pleural tissues (*12*). In this study, all fibers found in the parietal pleura were short (1 to 2 micrometers in length) Fibrils inactive in bioassays of cell transformation and carcinogenesis (*12*). No reference is provided by Nicholson *et al.* to substantiate their statement "that most mesotheliomas occur in the parietal pleura."

Nicholson *et al.* dismiss the results of in vitro experiments that used bacterial systems and mammalian cells because asbestos fibers are added to intact cells. They quote studies from their laboratory in which chrysotile fibers pre-incubated with naked DNA were used to transfect monkey kidney cells as a mechanism related to human cancer (*14*). We cited this paper and a similar study exploring asbestos-mediated transfection by viral RNA into mammalian cells (*15*) in our article. In the latter work, the efficiency of chrysotile asbestos fibers in transfection was compared with that of a number of asbestos and nonasbestos particulates. Under these circumstances, chrysotile asbestos was intermediate in rank (as was calcium phosphate) when compared with equal concentrations of a number of insoluble particles and fibers. The most efficient facilitators were kaolin and talc. Several epidemiologic studies on kaolin and talc workers exist, none of which have documented an increased cancer risk in individuals exposed to asbestos-free minerals. (*16*).

To assert that analytical techniques measuring asbestos-in-air on filters are "inadequate" because asbestos fibers were not observed in 83% of the samples, is incorrect. This observation merely indicates that fibers, if present, are at concentrations below the analytical sensitivity. As we indicated, the concentrations of asbestos-in-air reported in recent studies differ from those reported earlier, presumably because of differences in transfer techniques associated with sample examination in the transmission electron microscope, and not because of the possibility of analytical error. Comparisons between four studies of asbestos-in-air concentrations were recently presented by Chesson (*17*), who discussed the reasons for discrepancies in results and concluded that "levels are generally low," which is one of the major points of our paper.

BEST AVAILABLE COPY

The concept of "episodic" releases in buildings to support criticisms of air sampling as "snapshots in time" does not bear close scrutiny. Crump and Farrar (*18*) used a statistical approach to demonstrate that it was unlikely that not a single elevated concentration resulting from episodic release was detected in the Environmental Protection Agency (EPA)–sponsored study of buildings. It is more likely that releases of fibers resulting from intrusion of ACM creates elevated airborne fiber concentrations in close proximity to the source, but mixing with air results in rapid decrease of the concentration distant from the source. Thus, O&M programs are targeted to protect maintenance personnel from these short-term potential releases. The work of Sawyer (*19*) was based on phase contrast microscopy, a technique incapable of differentiating between asbestos fibers and other fibers. This is the more than likely explanation for the high concentrations he reported for short-term episodic releases.

Nicholson *et al.* cite an abstract by Oliver *et al.* (*20*) upon which they base their conclusions that "x-ray abnormalities and pulmonary function deficits have been associated with asbestos exposure among school custodians." We agree that some plaques occur in maintenance workers, but asbestosis is rare and, if present, is mild. We emphasize that this situation of asbestos exposure must be addressed under OSHA standards.

The lifetime risk estimates by U.S. government agencies in the past have been calculated from amphibole or mixed-fiber exposures and at fiber concentrations greater than actual fiber levels in buildings and schools. Regardless, the EPA estimate of risk for exposure to mixed fibers at 0.00024 fibers per cubic centimeter of air starting at age 5 and lasting for 13 years is approximately 4.8 *lifetime* deaths per million. Averaged over 70 years of remaining life (from age 5), this is less than 0.1 per million on an annual basis, or less than one in 10 million (and most of these are late in life) (*21*).

We understand the distinction for regulators between voluntary and involuntary health risks and recognize that society must make these choices. However, for both the general public and schoolchildren, all available scientific evidence indicates that ambient asbestos levels in air cannot cause asbestosis. In the 17,800 insulation workers with mixed-fiber exposure, 467 of 471 lung tumors were found in smokers (*22*). Whether the four tumors observed in nonsmokers occurred in smokers who quit or in those exposed to smoking passively is not clear. Nevertheless, if these observations are extrapolated to the environmental situation where concentrations of asbestos fibers in air are many thousands of times lower than those in past occupational settings, the apportionment of risk resulting from smoking increases dramatically. For these reasons, to suggest that asbestos in buildings causes lung cancer in the absence of smoking (a voluntary risk) is ill-founded. We emphasize that the risk of mesothelioma in the absence of amphibole exposure in schools and buildings is miniscule. Nicholson is on record as stating that "a few fibers [asbestos] will eventually cause disease" (*23*). Furthermore, his colleagues have described (*24*) asbestos in buildings as "the third wave of asbestos disease." Such emphasis is, in our opinion, scientifically invalid.

We agree that the EPA is now indicating that, in most cases, the best solution to ACM in buildings is to leave it in place and manage it with an O&M plan (*25*). The EPA now states that "the health risks to building occupants. . . appears to be low," and "removal is often not a building owner's best course of action" (*26*). When the agency issued its initial guidelines, school administrators were instructed to use an algorithm, later demonstrated to be invalid (*27*). The algorithm did not appear in later asbestos guidance documents from the agency, but it set the tone for subsequent emphasis on removal because its use usually resulted in a score that dictated that action, namely removal, be taken. The growth of the asbestos removal industry to its present $3.5 × 10^9$ gross sales per year (in 1989) stems largely from this early approach to the problem—an approach that ignored the role of air sampling in risk assessment that would place the problem in perspective. To imply that the asbestos removal industry operates on the principle that "removal is the option of last resort" is incorrect. Before publication, we discussed with the *Science* editors our public, governmental, consultative, and legal activities that have been on behalf of labor, school boards, and industry. The vague accusations of Samuels are politically orientated and unfounded. Our main objective as scientists in this field has been (and will continue to be) to protect the health of workers exposed to asbestos.

We thank Crump for the additional information and corrections to air sampling data provided in table 1 of our article.

B. T. Mossman
*Department of Pathology,*
*University of Vermont,*
*Burlington, VT 05405*
J. Bignon
*Unite INSERM de*
*Recherche sur la Biopathologie et*
*la Toxicologie Pulmonaire et Renale,*
*Creteil, France*
M. Corn
*Division of Environmental Health Engineering,*
*School of Hygiene and Public Health,*
*Johns Hopkins University,*
*Baltimore, MD 21205*
A. Seaton
*Institute of Occupational Medicine,*
*Edinburgh, Scotland EH8 9SU*
J. B. L. Gee
*Winchester Chest Clinic,* and
*Department of Internal Medicine,*
*Yale University School of Medicine,*
*New Haven, CT 06510*

---

### REFERENCES AND NOTES

1. L. Y. Chang, L. H. Overby, A. R. Brody, J. D. Crapo, *Am. J. Pathol.* **131**, 56 (1988); A. R. Brody and L. H. Overby, *ibid.* **134**, 133 (1989); P. D. McGavran, L. M. Moore, A. R. Brody, *ibid.* **136**, 695 (1990).
2. J. E. Craighead *et al.*, *Arch. Pathol. Lab. Med.* **106**, 541 (1982).
3. Ten milligrams of the International Union Against Cancer reference sample of chrysotile asbestos contains approximately 11.5 × $10^{10}$ fibers [G. Monchaux *et al.*, *Carcinogenesis* 2, 229 (1981)]. Brody's experiments were done at 4, 10, and 15 milligrams of chrysotile per cubic meter of air.
4. 29 Code *Fed. Reg.*, part 1911, sect. 1926, 58, as amended in *Fed. Reg.* **51**, 22612 (20 June 1986).
5. Collegium Ramazzini Workshop on Disease Potential of Different Asbestos Fiber Varieties, Ottawa, Ontario, Canada, 20 to 22 March 1989.
6. A. Churg, *Chest* **93**, 621 (1988).
7. A. Churg *et al.*, *Am. Rev. Respir. Dis.* **130**, 1042 (1984).
8. J. C. McDonald and A. D. McDonald, in *Asbestos-Related Malignancy*, K. H. Antman and J. Aisner, Eds. (Grune & Stratton, Orlando, FL, 1987), pp. 57–59.
9. J. S. Harington, *Nature* **193**, 45 (1962).
10. J. C. Wagner, G. Berry, J. W. Skidmore, V. Timbrell, *Br. J. Cancer* **29**, 252 (1974).
11. J. C. Wagner, D. Griffith, D. Munday, *Br. J. Ind. Med.* **44**, 749 (1987).
12. P. Sebastien *et al.*, in *Dusts and Diseases*, R. Lemen and J. M. Dement, Eds. (Pathotox, Park Forest South, IL, 1979), pp. 65–85.
13. T. W. Hesterberg and J. C. Barrett, *Cancer Res.* **44**, 2170 (1984); M. F. Stanton *et al.*, *J. Natl. Cancer Inst.* 67, 965 (1981); F. Pott, in *Assessment of Inhalation Hazards*, U. Mohr *et al.*, Eds. (Springer-Verlag, New York, 1990), pp. 242–251.
14. J. D. Appel, T. M. Fasy, D. S. Kohtz, J. D. Kohtz, E. M. Johnson, *Proc. Natl. Acad. Sci. U.S.A.* **85**, 7670 (1988).
15. G. R. Dubes and L. R. Mack, *In Vitro Cell Dev. Biol.* **24**, 175 (1988).
16. M. Kleinfeld, J. Messite, M. H. Zaki, *J. Occup. Med.* **16**, 345 (1974); G. F. Rubino, G. Scansetti, G. Piolatto, C. A. Romano, *J. Occup. Med.* **18**, 186 (1976); G. Sheers, *Br. J. Ind. Med.* **21**, 218 (1964).
17. J. Chesson, J. Hatfield, B. Schultz, E. Dutro, J. Blake, *Environ. Res.* **51**, 100 (1990).
18. K. S. Crump and D. B. Farrar, *Reg. Toxicol. Pharm.* **10**, 51 (1989).
19. R. Sawyer, *Environ. Res.* **13**, 146 (1977).
20. L. C. Oliver, N. L. Sprince, R. E. Green, *Am. Rev. Respir. Dis.* **139**, A211 (1989).
21. J. M. Hughes, personal communication.
22. W. Rom, paper presented at the Banbury Conference on Molecular Mechanisms of Fiber Cytotoxicity and Carcinogenesis, Cold Spring Harbor, NY, 14 to 17 March 1990.
23. Hartford *Courant*, 28 March 1990, p. 1.
24. "The Third Wave of Asbestos Disease: Exposure to Asbestos in Place. Public Health Control," meeting to be held in New York, NY, 7 to 9 June 1990.
25. *The ABC's of Asbestos in Buildings* (Environmental Protection Agency, Washington, DC, 1989).
26. L. J. Fisher, Office of Pesticides and Toxic Substances, Environmental Protection Agency, before

the Subcommittee on Health and Safety, Committee on Education and Labor, U.S. House of Representatives, Washington, DC, 3 April 1990; testimony before the Subcommittee on Toxic Substances, Environmental Oversight, Research and Development, Committee on Environment and Public Works, U.S. Senate, Washington, DC, 26 April 1990.

27. *Asbestos Containing Materials in School Buildings: A Guidance Document, Part 1* (Office of Toxic Substances, Environmental Protection Agency, Washington, DC, 1979); M. E. Findley, V. E. Rose, G. R. Cutter, R. A. Windsor, *Am. J. Publ. Health* 73, 1179 (1983).

JUNE 1, 1990

American
Association for the
Advancement of
Science

# SCIENCE

1 June 1990 $3.50
Vol. 248 • Pages 1049–1164

© Copyright Claimant: Reproduced by CRS for use of Members of Congress in their legislative duties

## Letters

### Asbestos Removal

Philip H. Abelson's editorial "The asbestos removal fiasco" (2 Mar., p. 1017), argues that huge sums of money have been wasted on the removal of asbestos from buildings due to "puzzling defect[s] in federal legislation and regulations." Abelson blames the policies and programs of the Environmental Protection Agency (EPA). Yet contrary to the premise of his editorial, if there is an "asbestos removal fiasco" in the United States, it is happening *in spite* of EPA's efforts.

Our agency only requires asbestos removal when building demolition or renovation activities threaten to release significant amounts of asbestos fibers into the air. Clearly, asbestos removal before the wrecking ball swings into action is a straightforward measure to protect public health.

Although EPA regulations rarely require asbestos removal, the agency is aware and concerned that a number of building owners are removing asbestos from their buildings—often due to forces (for example, concerns about property devaluation, insurance, and liability) that may be unrelated to actual health risks. As a result, EPA strongly recommends that, if asbestos-containing material is in good condition and is unlikely to be disturbed, it is generally preferable to contain that material where it is rather than remove it. EPA also warns building owners that an ill-conceived or poorly conducted removal can actually *increase* rather than decrease risk.

Abelson writes that there are several "defects" in EPA policies that contribute to the proliferation of asbestos removals. We at EPA and others in the scientific community see the matter quite differently. First, Abelson suggests that EPA has no scientific basis for treating the serpentine variety of asbestos, chrysotile, as equally hazardous to human health as the amphibole group, which includes crocidolite and amosite. Although available evidence suggests that exposure to chrysotile asbestos may be less likely to cause some asbestos-related diseases, a number of scientific organizations, including the National Academy of Sciences, maintain that chrysotile is a human carcinogen and that breathing airborne chrysotile fibers can cause all of the asbestos-related diseases. In drawing our conclusions, EPA listened to the National Academy of Sciences and other distinguished scientists. We took note of, but did not embrace the important, yet inconclusive, data referenced by Abelson.

Second, Abelson chides EPA for a "lack of concern about determining the facts of exposure," adding "one would think that in a $50 to $150 billion program the first priority would be an accurate assessment of the problem." I would agree if this were the situation. It isn't. EPA has *not* instituted the multibillion-dollar program that Abelson criticizes. EPA is doing essentially what he recommends—assessing the actual exposure levels in buildings through a major research effort by means of the Health Effects Institute (HEI).

Finally, Abelson argues that decisions concerning what to do about asbestos in buildings "should be based on actual measurements of types and amounts of [airborne] fibers" rather than on visual inspection and bulk sampling of material, as EPA recommends. Although EPA agrees that air monitoring can be a useful supplement to physical inspection, it cannot replace physical inspection as a means of assessing the asbestos hazard in buildings. Air monitoring, no matter how sophisticated the method, still only offers a snapshot of airborne asbestos at that moment and cannot predict the potential for future fiber releases caused by inadvertent or deliberate disturbances of the building's asbestos-containing material.

Would that the asbestos-in-buildings issue were as easy to manage as Abelson suggests, that is, that we can simply set up air monitors in buildings to determine if they have significant airborne concentrations of amphibole fibers. Unfortunately, as many in the scientific community recognize, assessing and controlling the potential asbestos hazard in buildings is a more complex undertaking.

It is our mandate at EPA to protect the health of those who live and work in our nation's buildings. We are presently taking several major steps to help ensure that our asbestos policies and programs are adequate to achieve that goal. We are concluding a year-long policy dialogue with various affected groups on how best to address asbestos in public and commercial buildings, conducting a thorough evaluation of the asbestos-in-schools program (due in early 1991), completing an important guidance document on managing asbestos in place, and sponsoring the HEI research noted above. These and other activities will help us improve our asbestos policies and programs and, as a result, better protect public health.

WILLIAM K. REILLY
*Administrator,*
*Environmental Protection Agency,*
*401 M Street, SW,*
*Washington, DC 20460*

The University of Vermont
DEPARTMENT OF PATHOLOGY
MEDICAL ALUMNI BUILDING, BURLINGTON, VERMONT 05405-0068
TEL: (802) 656-2210
FAX: (802) 656-8892

May 16, 1990

Ms. Stephanie Clough
U.S. Senate
Committee on Environment and Public Works
Hart Senate Office Building, Rm. 508
Washington, D.C.  20510

Dear Ms. Clough:

In accordance with our conversation approximately 10 days ago, I am enclosing our reply to the letter by Nicholson, et al. submitted to Science magazine in response to our recent article "Asbestos: Scientific Developments and Implications for Public Policy." I would appreciate your including it with the testimony at the recent hearings on asbestos held before your subcommittee. I understand that Dr. Landrigan, a co-author of the Nicholson letter, submitted the rough-draft of their letter to you as testimony. As I emphasized in our conversation and confirmed with Christine Gilbert, the Letter's editor of Science, Science and other journals have an embargo on articles and letters before publication. Therefore, it was inappropriate for Dr. Landrigan to present and distribute the letter to persons present at the hearings. Since the embargo has been already broken by the Nicholson group, she has given me permission to send you the galley proofs of their reply to our Science letter as well as our reply to their critique.

As we point out, Nicholson et al. present several misconceptions and misinterpretations of our data which are addressed in our letter. I would like to re-emphasize the inappropriateness of short-term animal studies for assessing the carcinogenicity of dusts when the durability of the asbestos fibers, certainly the amphiboles, appear to be the important determinants of carcinogenicity in the human lung over the 25 or more years latency of disease.

I am also appending the summary report of a recent meeting at the International Agency for Research on Cancer (also sponsored by the World Health Organization) which supports the conclusions and data presented in our Science paper. These comments by Sir Richard Doll, a leading epidemiologist in the field, were reflective of the presentations at this meeting. Please include, if possible, the galleys of the Nicholson letter as well as our response and Sir Richard Doll's comments in the testimony before your committee.

In 1982, I was appointed as a member of the National Research Council of the National Academy of Sciences under contract #68-01-4655 from the Environmental Protection Agency to prepare a report "Asbestiform Fibers: Non-occupational Health Risks" concerned with the degree of risks associated with different types of asbestiform fibers. We expressed in this report (1984) concern about difficulties in drawing firm conclusions about health risks of asbestos fibers and concluded that all the materials studied in our report would not necessarily cause adverse health risks. In fact, we quote "some of the materials may prove to pose negligible health risks at non-occupational levels of exposure and some may pose risks of concern." We estimated individual life-time risks from continuous exposure to asbestos without differentiating between fiber types. However, these risks had a high degree of uncertainty and were within the range of "acceptable risks by the EPA." Shortly thereafter, the EPA contracted the Airborne Asbestos Health Assessment Update from Dr. Nicholson. Corbett McDonald, from McGill University, and I were asked to critique the document which was reviewed at a meeting before the Scientific Advisory Board (SAB) of the EPA in June of 1984. We pointed out many of the discrepancies between our previous report and the risk assessments put forth by Nicholson in the document. The document was published despite criticisms from myself, Dr. McDonald, Sir Richard Doll, Julian Peto, and the SAB. The Nicholson document served as the basis of the AHERA regulations in schools. I reiterate the importance of recent data showing that chrysotile asbestos should not be considered as potent as other types of asbestos in mesothelioma. These views have been endorsed at a number of scientific meetings. If I can help you further or provide any of the documentation concerning critiques on the original Nicholson document, I would be happy to do so.

Sincerely,

Brooke Mossman

Brooke T. Mossman, Ph.D.
Associate Professor

INTERNATIONAL AGENCY FOR RESEARCH ON CANCER (WHO)
COMMISSION OF THE EUROPEAN COMMUNITIES

# NON-OCCUPATIONAL EXPOSURE TO MINERAL FIBRES

EDITORS: J. BIGNON, J. PETO & R. SARACCI

IARC SCIENTIFIC PUBLICATIONS
N° 90
LYON 1989

# MINERAL FIBRES IN THE NON-OCCUPATIONAL ENVIRONMENT: CONCLUDING REMARKS

**R. Doll**

*Imperial Cancer Research Fund Cancer Epidemiology and*
*Clinical Trials Unit, Radcliffe Infirmary,*
*Oxford, UK*

## *Introduction*

The symposium on which this volume is based came at a particularly opportune time, when people in many countries had been subjected to so much publicity and misinformation about the effects of asbestos, that many believed that exposure to one fibre carries with it a material hazard of developing cancer. Much anxiety has been, in consequence, caused by the realization that the ambient air contains fibres of asbestos or of other materials that can be, and often are, described as being like asbestos, and action is called for that has social costs out of all proportion to the possible benefits, as is described so vividly by Major & Vardy. There is, therefore, an urgent need for scientists to determine precisely which fibres are carcinogenic, how great the concentration of fibres is likely to be under different conditions, and the size of the risks that exposure to these concentrations is liable to produce.

## *Characteristics of carcinogenic fibres*

The information that was given in part II together with that reviewed recently by the International Programme on Chemical Safety (World Health Organization, 1986) and the International Agency for Research on Cancer (1987a,b, 1988) go a long way to enabling us to reach a conclusion about the characteristics of those fibres that are liable to cause cancer. These, it is clear, are not limited to the many varieties of asbestos, but pertain to many of the mineral fibres irrespective of whether they occur in nature, such as erionite and attapulgite, or are made by man from slag, rock or glass or from blends of silica, alumina, zirconia, and other materials fused to make ceramics. Two characteristics that all these materials have in common are a capacity to persist in animal tissues for months, if not for years, and a physical form such that their length is often more than 5 μm while their diameter is less than 2 μm. Properly speaking, no particle should be described as a fibre unless it is at least 5 μm long and the diameter is less than one-third of its length. This, however, is commonly overlooked and much shorter particles are described as fibres if they are made of the same material as long ones, and I shall follow the common practice. It is unfortunate, however, that this practice has evolved, as there is increasing evidence that short fibres (properly described as elongated particles) are much less carcinogenic, if they are carcinogenic at all. It is now 15 years since Stanton and Wrench (1972) and Pott and Friedrichs (1972) independently found that the physical dimensions of fibres were a major factor in determining their ability to cause cancer when injected intrapleurally or intraperitoneally; however, the difficulty in obtaining sufficient numbers of fibres of defined sizes made it difficult to be sure that the same was true when fibres were inhaled. The data that Davis reported now make it highly probable that the physical dimensions of the fibres are equally important in these circumstances and, taken in conjunction with the many studies of the effect of fibres on intrapleural, intraperitoneal, or intratracheal injection, they indicate that, to quote Davis, 'fibres $<5$ μm in length may be innocuous in lung tissue'.

This conclusion, if borne out, is of profound importance, for the great majority of so-called fibres that are normally found in air in and out of doors are less than 5 μm in length.

No-one would, I think, now question the conclusion that short so-called fibres are less likely to cause cancer than long ones, but the conclusion that there is a cut-off point somewhere in the region of 5–10 μm, below which fibres are not carcinogenic, is more dubious. It may be correct, but would be easier to accept ~~if~~ the mechanism were known by which fibres caused cancer and if it were possible to show that the mechanism was triggered only by fibres longer than (say) 5 μm.

In our present state of incomplete understanding this cannot now be done. It is still not even clear whether asbestos fibres are generally genotoxic. Jaurand's review makes clear that genotoxicity has been demonstrated in hamster embryo cells and in rat mesothelial cells, but, despite many experiments, asbestos has never been shown to be genotoxic in tracheobronchial epithelium. Fibres do, however, lead to the release of superoxide, and this may cause collagen to be formed and fibrosis produced. It may be, therefore, that asbestos is a complete carcinogen only for the mesothelium and that it acts to produce bronchial carcinoma less directly — a conclusion that is supported by the epidemiological data on the differential effects of age at first exposure for the two types of cancer reported by Professor Peto. In these circumstances, the essential difference between long and short fibres would seem to be that fibres less than 10 μm long are removed more readily by macrophages. We should note also, however, that the longer fibres cause more superoxide to be released and that, in some special types of cell, they have been shown to induce transformation more readily, interfere more with the movement of chromosomes at mitosis, and cause more aneuploidy.

## *Concentration of fibres in the environment*

It seems, therefore, that for practical purposes the best we can now do is to work on the assumption that all fibres that meet the criteria of the International Agency for Research on Cancer (IARC, 1988) for proven carcinogenicity in animals should be regarded as potentially carcinogenic to humans, but that we should base our estimate of potential risk on both the chemical constitution of the fibres and their size, counting only those fibres that are respirable and more than 5 μm long. This may lead to an underestimation of risk if short fibres also have some effect and are in the great majority, but it will be less misleading than if we base our estimate on the total fibre count or the total mass. Unfortunately, this means that we must measure ambient pollution by electron microscopy, as optical microscopy, which is fine in an occupational setting where nearly all fibres will be of one specific type, is useless for measuring ambient pollution, as it is unable to distinguish mineral fibres from others that are commonly the predominant type in the general environment, leave alone distinguish one type of mineral fibre from another.

It must be admitted, however, that fibre counting by electron microscopy fails to take cognizance of the clumps of fibres that may occasionally occur, as Professor Nicholson and Dr Burdett pointed out, and that this could be a matter of some concern if any substantial proportion of the clumps penetrate to the lung.

With or without this qualification it is evident that fibres that are potentially carcinogenic are present ubiquitously, due partly to the weathering of geological formations and partly to man's activities. According to the recent report of the International Programme on Chemical Safety (World Health Organization, 1986), more fibres are probably emitted due to the former than the latter. Those emitted from natural sources are, however, of less practical importance as they are dispersed throughout sparsely populated areas, whereas those emitted from the sources listed by Professor Nicholson (the operation of mines and mills, the construction and demolition of buildings, vehicle braking, and the wear and tear of domestic appliances and of the material used in house construction) disperse fibres principally in areas of high population density.

Most of the reports in this volume agree that the concentration of such fibres, even in densely populated areas, is low. Typical data for asbestos fibres are presented by Burdett. These showed that concentrations of fibres more than 5 μm in length might be as great as 0.012 fibres per ml (f/ml) in a room with a large area of damaged asbestos, but that the air in less than a quarter of the buildings (9/39) which contained sprayed asbestos, asbestos plaster, or warm air heaters containing asbestos gave average concentrations greater than their limits of quantification, taken (for this study) to be a count of 4 fibres. Four sets of samples above the limits of quantification gave on average figures of 0.0009 f/ml for buildings with sprayed or trowelled asbestos insulation or plaster, while 5 for buildings with air heaters containing asbestos gave an average of 0.0008 f/ml. The other 30 similar buildings with sample counts below the limit of quantification must have given a considerably lower average, and an overall figure of 0.0005 f/ml is more likely to be an overestimate than an underestimate. Chrysotile and amosite were each identified in over half the buildings (56%), but crocidolite was identified in only 2 (5%). In one-sixth of the buildings (18%), no type could be identified as no asbestos fibres were seen.

Further information that Burdett and his colleagues provided is, I think, important for purposes of control: namely, that even with the adoption of complex systems for the containment of contamination, the removal of asbestos from parts of a building led to substantial contamination in other parts and that higher fibre counts than had been present previously (sometimes an order of magnitude higher) persisted for many weeks.

Out of doors, counts of asbestos fibres made in the recommended way have generally been less than 0.0005 f/ml. Too few have, however, been reported to allow any representative figure to be given, except for Japan where Kohyama reported a mean of 0.0004 f/ml, based on a massive series of hundreds of counts throughout the country. These, in agreement with other observations, revealed that counts were consistently raised in areas of heavy traffic.

Fewer data still are available for other types of fibre, the carcinogenicity or potential carcinogenicity of which has been appreciated only relatively recently, but it seems clear that the concentrations are generally less. Two sets of figures have been cited, one for 3 German cities, where the concentrations of glass fibres averaged about one-quarter of that for asbestos, and another for Paris, where Dr Gaudichet and her colleagues obtained counts of synthetic fibres out of doors (using a polarized optical microscope) that were nearly 2 orders of magnitude lower, namely $4 \times 10^{-6}$ f/ml. Indoors, within buildings in which synthetic fibres were known to have been applied by spraying, the counts were 40–60 times greater. All these counts were, however, of total fibres and so can give only an upper limit to any postulated cancer hazard.

One surprising finding, in the light of the epidemiological data, is that of the relatively low fibre counts in the Turkish villages, where Dr Simonato and his colleagues confirmed the existence of a high mortality from mesothelioma and lung cancer. The fibre counts that they obtained were certainly higher than in industrialized countries, averaging about 0.006 f/ml, but even in homes and other places where people lived or (in the case of children) played, the counts were seldom greater than 0.1 f/ml, and the highest, recorded in a cave used as a home, was only 0.3 f/ml. There was, moreover, not much difference between the 3 affected villages and the one unaffected. In one village, asbestos contributed up to 10% of the short fibres, but most of the fibres, particularly in the 3 affected villages, were of erionite which, according to Wagner *et al.* (1985), has a greater carcinogenic potency than any of the other mineral fibres that they have tested.

## *Assessment of risk*

Assessment of any risks associated with these low counts can, for the most part, be only indirect, as the fibre counts to which people have been exposed are so far below the levels at which it has been possible to detect risks in industry. The one possible exception is that to which I have just referred: namely, the high risks of mesothelioma and lung cancer in the Turkish villages of Karain, Sarihidir, and Tuzköy. Mesotheliomas accounted for 50% of adult deaths in one of these villages in a 4-year period and 16% and possibly more in 2 of the others, giving annual mesothelioma death rates varying from 2.5 to 14.1 per 1000, as compared with typical non-occupational rates of under 0.002 per 1000 in Europe and North America and a maximum rate in asbestos insulation workers of 4 per 1000. Lung cancer death rates of approximately 6 per 1000 in men were, in contrast, only about 3 to 4 times greater than in Britain and perhaps 17 times greater than in the whole of Turkey. Simonato suggests that exposures in the past, when houses tended to have been built of local stone, may have been higher than they are now, when houses tend to be built of brick, and this is supported by Professor Sébastien's report that the mean number of coated fibres in the sputum of people living in affected villages was 200 times that of people living elsewhere. Otherwise it seems that erionite must be accorded a bizarrely high risk, even compared with crocidolite, if local environmental pollution is accepted, as I think it must be, as the principal cause of the disease.

In assessing the hazards from other types of environmental exposure, we must distinguish between the risks of mesothelioma, lung cancer, and other types of cancer, between man-made mineral fibres and asbestos, and between the various types of asbestos.

So far as man-made mineral fibres are concerned, we have heard very little about them, doubtless for the reason that they have not been unequivocally demonstrated to cause cancer in humans, despite many thousands of men and women having been exposed occupationally for several decades to substantially greater concentrations than are likely to be met in the general environment. The observations that have been made on occupationally exposed men and women led the International Agency for Research on Cancer (IARC, 1988) to conclude that there was limited evidence for the carcinogenicity to man of rock or slag wool fibres, but no clear evidence of any such effect from glass wool fibres and no data at all that would help to determine the carcinogenicity of ceramic fibres. This balanced opinion is perhaps a little conservative (Doll, 1987), but it is certainly the case that there is no reason to suppose that any man-made mineral fibres have caused mesotheliomas (perhaps because most of them are insufficiently durable in human lungs) while any risk of lung cancer can be only small and, at present, unquantifiable. It is obviously wise to keep an eye on the trends in environmental exposure and to avoid unnecessary exposure to such fibres, in so far as this can be achieved without great social cost, but the environmental risk may well be so small that an informed society would wish to ignore it.

Asbestos, however, presents a far more difficult problem. Firstly, there is the difference between the effects of chrysotile and amphiboles, which is so great in relation to mesothelioma that it is possible to argue that chrysotile does not cause mesothelioma at all and that the relatively few cases that have occurred in men occupationally exposed to chrysotile have been due to the presence of an unintended contamination with minute amounts of tremolite. Secondly, there is the possibility that the dose-response relationships differ quantitatively for mesothelioma and lung cancer, and thirdly there is the question of whether the ingestion of asbestos causes cancer in sites other than the lung and the epithelial lining of the pleura.

That pure chrysotile does not cause mesothelioma is strongly suggested by the low incidence of the disease in groups of men and women occupationally exposed only to chrysotile (with or without some contamination by tremolite) and by the results of tissue analyses which have repeatedly shown that the lungs of people who have died of mesothelioma contain very little (if any) more chrysotile than the lungs of those who have died of non-asbestos-related diseases, once the amount of any associated amphibole is taken into account. This was illustrated beautifully by the new data that

Dr Gibbs and his colleagues and Professor McDonald and his colleagues presented. That chrysotile should produce less pleural disease than amphibole asbestos is understandable, in view of the greater speed with which it is removed from the lung, but I hesitate to give it a completely clean bill of health. The data from Japan, presented by Professor Morinaga, provide perhaps the strongest evidence that mesotheliomas may be produced by pure chrysotile. In his series of cases graded qualitatively (+, ++, +++, ...) for chrysotile presence, the lungs of 4 out of 6 mesothelioma patients which did not appear to contain any amphibole asbestos (including any tremolite) were graded ++ or higher for chrysotile, whereas only one out of 17 control patients dying of other diseases was so categorized. As a working hypothesis I would suggest that, for similar amounts of exposure, chrysotile carries a risk of producing mesothelioma that is no more than 5% of that associated with an average mix of amphiboles and may even be less.

In contrast to these findings, there is no firm evidence to suggest that chrysotile carries a smaller risk of lung cancer than amphibole asbestos (though the risk has been notably low in miners and friction product and cement workers) and for the time being we must, I think, regard all types of asbestos as carrying an equal risk of cancer of the lung.

How great a risk of either disease people are likely to have incurred in non-occupational settings cannot be estimated directly, as no measurements have been made of the exposures that have caused cancer in the homes of asbestos workers or in the neighbourhood of asbestos mines, factories or dumps, and the concentrations to which the mass of the population are exposed in and out of doors are so low that it is impossible to design studies that will measure the difference between the different levels of risk involved. Mesotheliomas are, however, normally so rare in the absence of exposure to asbestos that the case-control and geographical studies reviewed by Professor Gardner have demonstrated, without possibility of cavill, that this disease has been produced by exposure to asbestos in the home or in the neighbourhood of sources of environmental pollution. It seems probable, therefore, that lung cancer may have been produced in the same way, but it has not been possible to demonstrate it epidemiologically. This may be because the background incidence of the disease is relatively so high — even in non-smoking women. Alternatively, it may be because this disease is not produced by low levels of exposure at all.

At present we can estimate the risks associated with current levels of non-occupational exposure only by extrapolating from the much higher levels that have been recorded in industry. This requires two things: the measurement of a relationship between dose and response and a theory that will justify extrapolation from high doses to very low ones. We can now make an informal guess at both the former and the latter in respect of mesothelioma, but our theory in respect of lung cancer is still largely a matter of unsupported faith. We have a substantial amount of data to support the idea that the incidence of lung cancer is proportional to the cumulative dose at high and moderate levels of exposure, but unless it can be shown that asbestos is generally genotoxic or, more specifically, genotoxic to the bronchial epithelium, we have no real grounds for postulating that a linear relationship for lung cancer can be extrapolated back to the levels of dose with which we are concerned in non-occupational settings.

If we leave this difficulty aside, we are then left with a host of minor difficulties relating partly to the measurement of dose, which has been peculiarly difficult in the asbestos industry in the past, and partly to our incomplete knowledge of the biological relationships between the incidence of cancer and the duration of dose, the age at which exposure occurred, and the time since it happened. These problems have been touched on by Professor Nicholson and Professor Peto and discussed in detail by some of the committees that have produced estimates of risk and are too complex to review again here. We should note, however, that the estimates all require major assumptions, for some of which the evidence is weak and partly contradictory. All the recent ones are, however, in broad agreement that the risk attributable to exposures to concentrations of (say) 0.0005 f/ml are extremely low and of the order of a life-time risk of 1 per 100 000 or less for 10 years exposure in school or 20 years exposure in adult life. That the actual risk cannot be much higher, if indeed it can be as high, is demonstrated, as Professor McDonald pointed out, by the low and relatively steady mortality from mesothelioma not obviously attributable to occupational exposure that is still observed in North America and Europe.

Whether we should need to add to this a further risk from gastrointestinal cancer due to the presence of asbestos fibres in water supplies is still, in my opinion, a subject for research. Professor Kanarek's excellent review showed that the ecological evidence could be interpreted to mean that the exceptionally large numbers of fibres in some of the water supplied to San Francisco might increase the risk of gastric and perhaps also of oesophageal cancer by 10% and that the lack of relationship observed in other similar studies did not necessarily contradict it. I do not think, however, that we should attribute a causal significance to this finding in the absence of experimental data to show that fibres can cause gastrointestinal cancer on ingestion and, as Dr Chouroulinkov showed, this is lacking, despite the many intensive efforts that have been made to obtain it. In the absence of such evidence and the doubt about the reality of risk of gastrointestinal cancer following occupational exposure, it is, I believe, more reasonable to attribute the San Francisco findings to confounding, despite the great trouble that has been taken to exclude it, particularly as we are unable to take into account any effect of variation in the prevalence of the principal cause of gastric cancer because this principal cause is still unknown.

## *Epilogue*

These remarks have not done justice to all the contributions in this volume. But even if they had done so, not all the important questions would have been answered completely and for ever. Further research, which is essential, will doubtless give different answers to some of the questions which we think have been adequately answered now. Our current answers are, however, sufficiently clear and, I suggest, reliable enough for practical policies to be determined for the control of exposure to mineral fibres which will allow social benefits to be assessed in relation to social costs. The carcinogenic effects of the fibres must be weighed against the tremendous contribution that mineral fibres have made and continue to make to human welfare by their durability, insulating power, and indestructibility by fire and friction.

## *References*

Doll, R. (1987) Symposium on MMMF, Copenhagen, October 1986: overview and conclusions. *Ann. Occup. Hyg.*, *31*, 805-820

IARC (1987a) *IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans*, Vol. 42, *Silica and Some Silicates*, Lyon, International Agency for Research on Cancer

IARC (1987b) *IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans*, Supplement 7, *Overall Evaluations of Carcinogenicity: An Updating of IARC Monographs Volumes 1-42*, Lyon, International Agency for Research on Cancer

IARC (1988) *IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans*, Vol. 43, *Man-made Mineral Fibres and Radon*, Lyon, International Agency for Research on Cancer

Pott, F. & Friedrichs, K.H. (1972) Tumours in rats after intraperitoneal injection of asbestos fibres. *Naturwissenschaften*, *59*, 318-332

Stanton, M.F. & Wrench, C. (1972) Mechanisms of mesothelioma induction with asbestos and fibrous glass. *J. Natl Cancer Inst.*, *48*, 797-821

Wagner, J.C., Skidmore, J.W., Hill, R.J. & Griffiths, D.M. (1985) Erionite exposure and mesotheliomas in rats. *Br. J. Cancer*, *51*, 727-730

World Health Organization (1986) *Asbestos and Other Natural Mineral Fibres*, Geneva (*Environmental Health Criteria, No. 53*)

II

101ST CONGRESS
1ST SESSION

# S. 1893

To reauthorize the Asbestos School Hazard Abatement Act of 1984.

---

IN THE SENATE OF THE UNITED STATES

NOVEMBER 16 (legislative day, NOVEMBER 6), 1989

Mr. LAUTENBERG (for himself, Mr. REID, Mr. BRADLEY, Ms. MIKULSKI, Mr. PELL, Mr. JEFFORDS, Mr. LIEBERMAN, Mr. DODD, Mr. BAUCUS, and Mr. GRAHAM) introduced the following bill; which was read twice and referred to the Committee on Environment and Public Works

---

# A BILL

To reauthorize the Asbestos School Hazard Abatement Act of 1984.

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,*

## SECTION 1. SHORT TITLE.

This Act may be cited as the "Asbestos School Hazard Abatement Reauthorization Act of 1989".

## SEC. 2. FINDINGS AND PURPOSES.

(a) FINDINGS.—Congress finds the following:

(1) Exposure to asbestos fibers has been found to cause various cancers and other severe or fatal diseases, such as asbestosis.

(2) Children are particularly susceptible to the adverse health effects of inhaling asbestos fibers.

(3) Asbestos which is friable can result in the release of asbestos fibers into the air, presenting a health hazard.

(4) The Environmental Protection Agency has estimated that more than forty-four thousand school buildings contain friable asbestos, exposing more than fifteen million school children and one million five hundred thousand school employees to unwarranted health hazards.

(5) All elementary and secondary schools are required by the Asbestos Hazard Emergency Response Act to inspect for asbestos, develop an asbestos management plan, and implement such plan.

(6) The Environmental Protection Agency has estimated it will cost local education agencies more than $3,000,000,000 to comply with the Asbestos Hazard Emergency Response Act.

(7) Without a continuing program of information assistance, technical and scientific assistance, training, and financial support, many local educational agencies will be unable to carry out sufficient response actions to prevent the release of asbestos fibers into the air.

(8) Without the provisions of sufficient financial support, the cost to local educational agencies of implementing asbestos response actions may have an adverse impact in their educational mission.

(9) The effective regulation of interstate commerce for the protection of human health and the environment requires the continuation of programs to mitigate hazards of asbestos fibers and materials emitting such fibers.

(b) PURPOSES.—The purposes of this Act are the following:

(1) To direct the Environmental Protection Agency to maintain a program to assist local schools in carrying out their responsibilities under the Asbestos Hazard Emergency Response Act.

(2) To provide continuing scientific and technical assistance to State and local agencies to enable them to identify and abate asbestos health hazards.

(3) To provide financial assistance to State and local agencies for training of persons involved with inspections and abatement of asbestos, for conducting necessary reinspections of school buildings, and for the actual abatement of asbestos threats to the health and safety of school children or employees.

(4) To assure that no employee of a local educational agency suffers any disciplinary action as a result of calling attention to potential asbestos hazards which may exist in schools.

### SEC. 3. AMENDMENTS TO ASBESTOS SCHOOL HAZARD ABATEMENT ACT OF 1984.

Except as otherwise specifically provided, whenever in this Act a section or other provision is amended or repealed, such amendment or repeal shall be considered to be made to that section or other provision of the Asbestos School Hazard Abatement Act of 1984 (20 U.S.C. 4011 et seq.).

### SEC. 4. ASBESTOS HAZARDS ABATEMENT PROGRAM.

Subsection (b) of section 503 is amended—

(1) in paragraph (2), by inserting "educational" after "local";

(2) in paragraph (2), by inserting ", including parent and employee organizations," after "institutions"; and

(3) by amending paragraph (3) to read as follows:

"(3) not later than 45 days after the appropriation of funds each year to carry out the asbestos hazards abatement program under this title, the development and distribution to all local educational agencies of an application form; and".

**SEC. 5. STATE RECORDS AND PRIORITY LISTS.**

(a) MAINTENANCE OF RECORDS.—Subsection (a) of section 504 is amended—

(1) by striking out "Not later than" and all that follows through "maintaining records on—" and inserting in lieu thereof "The Governor of each State shall maintain records on—";

(2) in paragraph (2), by inserting "and other response actions" after "abatement activities";

(3) by inserting "and" after the semicolon at the end of paragraph (2); and

(4) in paragraph (3), by striking out "subparagraph (B)" and inserting in lieu thereof "paragraph (2)".

(b) DELETION OF DEPARTMENT OF EDUCATION REFERENCES.—Subsection (b)(1) of section 504 is amended—

(1) by striking out "Not later than six months after the date of the enactment of this title and annually thereafter," and inserting in lieu thereof "Each year, in accordance with procedures established by the Administrator,";

(2) in subparagraphs (A) and (B), by striking out "and the Secretary of the Department of Education" both places it appears;

(3) in subparagraph (A), by inserting "and" after the semicolon at the end of such subparagraph; and

(4) by striking out subparagraph (C).

(c) Determination of Adequacy of Resources.—Subsection (b)(4) of section 504 is amended—

(1) by redesignating subparagraph (F) as subparagraph (G); and

(2) by inserting after subparagraph (E) the following new subparagraph:

"(F) Any additional costs to the local educational agency of meeting the special needs of disadvantaged students.".

(d) Conforming Amendment.—Section 504 is further amended by striking out subsection (c).

**SEC. 6. FINANCIAL ASSISTANCE.**

(a) Application Approval Deadline.— Subsection (b) of section 505 is amended—

(1) in paragraph (2), by striking out "applications shall be submitted," and inserting in lieu thereof "the Governor shall submit applications,";

(2) in paragraph (2), by adding at the end the following: "The Administrator shall approve or disapprove applications for financial assistance no later than April 30 of each year."; and

(3) by striking out paragraph (3).

(b) Ranking Applications.—Subsection (c)(2)(B)(iv) of section 505 is amended by striking out "is cost-effective compared to other techniques including management of material containing asbestos" and inserting in lieu thereof "uses the least burdensome methods which protect human health and the environment".

(c) DELETION OF REFERENCE TO DEPARTMENT OF EDUCATION REPORT.—Subsection (c)(3) of such section is amended by striking out "shall consider—" and all that follows through the end of the paragraph and inserting in lieu thereof the following: "shall consider the financial resources available to the applicant as certified by the Governor pursuant to section 504(b)(4).".

(d) ADDITIONAL LIMITATION.—Subsection (d) of such section is amended to read as follows:

"(d) LIMITATION.—In no event shall financial assistance be provided under this title to an applicant if—

"(1) the Administrator determines that such applicant has resources adequate to support an appropriate asbestos materials abatement program; or

"(2) the applicant is not in compliance with title II of the Toxic Substances Control Act (15 U.S.C. 2641 et seq.).".

(e) REQUIREMENT TO DEPOSIT FUNDS INTO ASBESTOS TRUST FUND.—Subsection (f) of such section is amended in paragraph (3) by striking out "for deposit in the general fund" and inserting in lieu thereof the following: "for deposit in the Asbestos Trust Fund established by section 5 of the Asbestos Hazard Emergency Response Act (Public Law 99-519; 20 U.S.C. 4022)".

(f) ADDITIONAL REQUIREMENTS FOR APPLICATION APPROVAL.—Subsection (g) of such section is amended—

(1) in paragraph (1), by striking out "within the five-year period beginning on the effective date of this title" and inserting in lieu thereof "in accordance with such procedures as may be developed by the Administrator";

(2) in paragraph (2)(B), by amending clauses (i) and (ii) to read as follows:

"(i) the local educational agency has prepared and is implementing an asbestos management plan, as required under title II of the Toxic Substances Control Act (15 U.S.C. 2641 et seq.); and

"(ii) all activities to be conducted with the financial assistance will be performed by individuals trained and accredited in conformance with title II of the Toxic Substances Control Act (15 U.S.C. 2641 et seq.) and regulations promulgated under that title;"; and

(3) by striking out paragraph (4).

**SEC. 7. ADMINISTRATIVE PROVISIONS.**

Section 506 is amended—

(1) by redesignating subsection (c) as subsection (d); and

(2) by striking out subsection (b) and inserting in lieu thereof the following:

"(b) PROCEDURES.—The Administrator also shall establish procedures to be used by local educational agencies, in programs for which financial assistance is made available under section 505, for—

"(1) abating asbestos materials in school buildings;

"(2) replacing the asbestos materials removed from school buildings with other appropriate building materials; and

"(3) restoring such school buildings to conditions comparable to those existing before asbestos containment or removal activities were undertaken.

"(c) RELATIONSHIP TO OTHER LAWS.—Nothing contained in this title shall be construed, interpreted, or applied to diminish in any way the level of protection required under any other State or Federal worker protection or other applicable laws.".

**SEC. 8. ANNUAL REPORT.**

(a) REPORT DEADLINE.—The first sentence of section 507 is amended to read as follows: "During each calendar year until 1999, the Administrator shall prepare and submit, not later than June 1 of each year, to the Committee on Environment and Public Works of the Senate and to the Committee on Energy and Commerce of the House of Representatives a report on the loan and grant program authorized by section 505 of this title.".

(b) CONTENTS OF REPORT.—Paragraph (6) of such section is amended by inserting before the period the following: "and the amount of resources needed by such schools, categorized by State, to abate all remaining asbestos hazards".

### SEC. 9. RECOVERY OF COSTS.

Paragraph (2) of section 508(a) is amended by inserting after "repay to the United States," the following: "by deposit in the Asbestos Trust Fund established by section 5 of the Asbestos Hazard Emergency Response Act (20 U.S.C. 4022),".

### SEC. 10. DEFINITIONS.

Section 511 is amended—

(1) in paragraph (3), by inserting ", vibration," after "damage from water"; and

(2) by adding at the end the following new paragraph:

"(9) The term 'response action' has the meaning given such term by section 202(11) of the Toxic Substances Control Act (15 U.S.C. 2642(11).".

## SEC. 11. AUTHORIZATION.

(a) AUTHORIZATION.—Paragraph (1) of section 512(a) is amended to read as follows: "(1) There are hereby authorized to be appropriated for the asbestos abatement program not more than $250,000,000 for each of fiscal years 1991, 1992, 1993, 1994, and 1995.".

(b) SPECIFIC PROGRAMS.—Subsection (b) of section 512 is amended by striking out paragraph (2) and inserting in lieu thereof the following:

"(2) Of those sums appropriated for the implementation of this title, not more than 5 percent may be reserved during each fiscal year for the administration of this title and for programs including (but not limited to) the following:

"(A) The establishment of training centers for contractors, engineers, school employees, parents, and other personnel to provide instruction, in accordance with title II of the Toxic Substances Control Act (15 U.S.C. 2641 et seq.), on asbestos assessment and abatement.

"(B) The development and dissemination of abatement guidance documents to assist in evaluation of potential hazards and the determination of proper abatement programs.

"(C) The development of rules and regulations regarding inspection, reporting, and recordkeeping.

"(D) The development of a comprehensive testing and technical assistance program.

"(3) Of those sums appropriated for any fiscal year for the implementation of this title, the Administrator may use not more than 5 percent to provide grants to States for the following purposes:

"(A) Assisting local educational agencies in performing the periodic reinspections and training activities required under title II of the Toxic Substances Control Act (15 U.S.C. 2641 et seq.).

"(B) Establishing and maintaining programs to accredit personnel performing asbestos inspections and response actions.".

### SEC. 12. CONFORMING AMENDMENTS TO ASBESTOS TRUST FUND.

(a) Amounts Transferred to Trust Fund.—Section 5(b)(1) of the Asbestos Hazard Emergency Response Act of 1986 (Public Law 99–519) is amended—

(1) in subparagraph (A), by striking out "as in effect on the date of the enactment of this Act, and" and inserting in lieu thereof a comma;

(2) in subparagraph (B), by striking out the period at the end and inserting in lieu thereof ", and"; and

(3) by adding at the end the following new subparagraph:

"(C) amounts received as proceeds from any judgment recovered in any suit brought pursuant to section 508(a)(1) of the Asbestos School Hazard Abatement Act of 1984 (20 U.S.C. 4017(a)(1))."

(b) EXPENDITURES FROM TRUST FUND.—Section 5(d) of such Act is amended by striking out "as in effect on the date of the enactment of this Act".

### SEC. 13. TECHNICAL AMENDMENTS.

(a) SECTION HEADINGS.—(1) Section 501 is amended by striking out "SEC. 501." and inserting the following section heading:

**"SEC. 501. SHORT TITLE.".**

(2) Section 502 is amended by striking out the section heading and "SEC. 502." and inserting in lieu of the section heading the following:

**"SEC. 502. FINDINGS AND PURPOSES.".**

(3) Section 503 is amended by striking out the section heading and "SEC. 503." and inserting in lieu of the section heading the following:

**"SEC. 503. ASBESTOS HAZARD ABATEMENT PROGRAM.".**

(4) Section 504 is amended by striking out the section heading and "SEC. 504." and inserting in lieu of the section heading the following:

**"SEC. 504. STATE RECORDS AND PRIORITY LISTS.".**

(5) Section 505 is amended by striking out the section heading and "SEC. 505." and inserting in lieu of the section heading the following:

**"SEC. 505. FINANCIAL ASSISTANCE.".**

(6) Section 506 is amended by striking out "SEC. 506." and inserting the following section heading:

**"SEC. 506. ADMINISTRATIVE PROVISIONS.".**

(7) Section 507 is amended by striking out "SEC. 507." and inserting the following section heading:

**"SEC. 507. ANNUAL REPORT.".**

(8) Section 508 is amended by striking out "SEC. 508" and inserting the following section heading:

**"SEC. 508. RECOVERY OF COSTS.".**

(9) Section 509 is amended by striking out "SEC. 509." and inserting the following section heading:

**"SEC. 509. EMPLOYEE PROTECTION.".**

(10) Section 510 is amended by striking out "SEC. 510." and inserting the following section heading:

**"SEC. 510. AFFECT ON RIGHTS UNDER OTHER LAWS."**

(11) Section 511 is amended by striking out "SEC. 511." and inserting the following section heading:

**"SEC. 511. DEFINITIONS.".**

(12) Section 512 is amended by striking out "SEC. 512." and inserting the following section heading:

**“SEC. 512. AUTHORIZATION.”.**

(b) Subsection Headings.—(1) Section 502(a) is amended by inserting “Findings.—” after “(a)”.

(2) Section 502(b) is amended by inserting “Purpose.—” after “(b)”.

(3) Section 503(a) is amended by striking out “(1)” and inserting in lieu thereof “Abatement Program.—”.

(4) Section 503(b) is amended by inserting “Duties.—” after “(b)”.

(5) Section 504(a) is amended by inserting “Records.—” after “(a)”.

(6) Section 504(b) is amended—

(A) by inserting “Priority List.—” after “(b)”;

(B) by inserting “activities and other response actions” after “abatement” each place it appears in subparagraphs (A) and (B) of paragraph (1);

(C) in paragraph (1)(B), by striking out “section 503(b)(3) and”; and

(D) in paragraph (4)((C), by inserting a comma after “per capita income”.

(7) Section 505 is amended—

(A) in subsection (a), by inserting “Assistance Program.—” after “(a)”;

(B) in subsection (b), by inserting “Application Submission.—” after “(b)”;

(C) in subsection (c), by inserting "REVIEW OF APPLICATION.—" after "(c)";

(D) in subsection (e), by inserting "AMOUNT OF LOAN OR GRANT.—" after "(e)";

(E) in subsection (f), by inserting "LOAN AGREEMENT.—" after "(f)"; and

(F) in subsection (g), by inserting "APPLICATION REQUIREMENTS.—" after "(g)".

(6) Section 506(a) is amended by inserting "REGULATIONS.—" after "(a)".

(7) Section 506(d) (as redesignated by section 7) is amended—

(A) by inserting "OTHER AUTHORITY.—" after "(d)"; and

(B) by inserting a comma after "standards" the first place it appears.

(8) Section 508(a) is amended by inserting "LOAN CONDITION.—" after "(a)".

(9) Section 508(b) is amended by inserting "EXPEDITIOUS RECOVERY.—" after "(b)".

(c) MISCELLANEOUS TECHNICAL AMENDMENTS.—(1) Section 505(b) is amended in paragraph (1) by striking out the comma after "educational agency".

(2) Section 505(c) is amended—

(A) in paragraph (2), by inserting "and" after the semicolon at the end of subparagraph (A); and

(B) in paragraph (2), by inserting a comma after "confined space" in subparagraph (B)(ii) and after "techniques" in subparagraph (B)(iv).

(3) Section 505(e) is amended by striking out "per centum" both places it appears and inserting in lieu thereof "percent".

(4) Section 505(g) is amended—

(A) by redesignating the subparagraph (B) appearing after paragraph (3) as paragraph (4) and conforming the margin accordingly; and

(B) by inserting a comma in paragraph (4) (as so redesignated) after "section 512(b)(1)".

(5) Section 508 is amended by striking out "sections" and inserting in lieu thereof "section".

(6) Section 511 is amended—

(A) by striking out "For purposes of this title—" and inserting in lieu thereof "For purposes of this title:";

(B) by striking out "the" at the beginning of each paragraph and inserting in lieu thereof "The";

(C) by striking out the semicolon at the end of each paragraph and inserting in lieu thereof a period;

(D) by striking out the word "each" in paragraph (3); and

(E) by inserting "secondary" before "school" in paragraph (5).